Human-Machine Interfaces (HMI)

An orientation guide

KEBA
Automation by innovation.

Introduction

Human-machine interfaces (HMI) are the interface between man and machine.

The design of intuitive HMIs makes the operation of machines easier, safer and more productive. A well thought-out HMI concept and software design helps to improve the usability, efficiency and user-friendliness of an HMI and ultimately gives a company an important competitive advantage an important competitive advantage.

However, the path to the ideal HMI solution is not always easy. In this guide, we provide you with valuable insights and tips on how to optimise your HMI software design and point out typical mistakes to avoid when creating HMI concepts.

This guide should give orientation for the development, design and introduction of innovative operator interfaces for machine and plant control systems.

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For all machines and systems

A single user interface (HMI)

Let's take the simplest example – two machines with different control systems. That means that on machine A with control system X, the application has been created using the software from control system manufacturer X, and likewise on machine B with control system Y, a different manufacturerspecific solution is being used. The human machine interface of each machine or system can be stationary or mobile. The mobile solutions in turn employ different HMIs for operating the machines.

Given the high degree of automation of modern machines, operators typically intervene only briefly in machine processes. For greater efficiency, a single operator looks after multiple machines. Experienced operators have no problem with switching from one HMI device to another, even if dealing with different types of machines from different manufacturers. But each switch to a different device or machine does involve an increased cognitive effort for the operator. These switching losses reduce efficiency.

The reduced efficiency comes coupled with an increased error susceptibility. Since the positions of the buttons and safety elements vary between the devices, users must cope with constantly changing ergonomics. In addition, many companies face greater expenses when it comes to training their staff. Because of the large number of different systems, new employees or temp workers must receive a significant amount of intensive training, which costs time and money. Moreover, the use of different interfaces for the different machines requires more work of the operators. They need to comprehend and know how to apply a variety of different solutions for problems that are frequently quite similar.

The solution

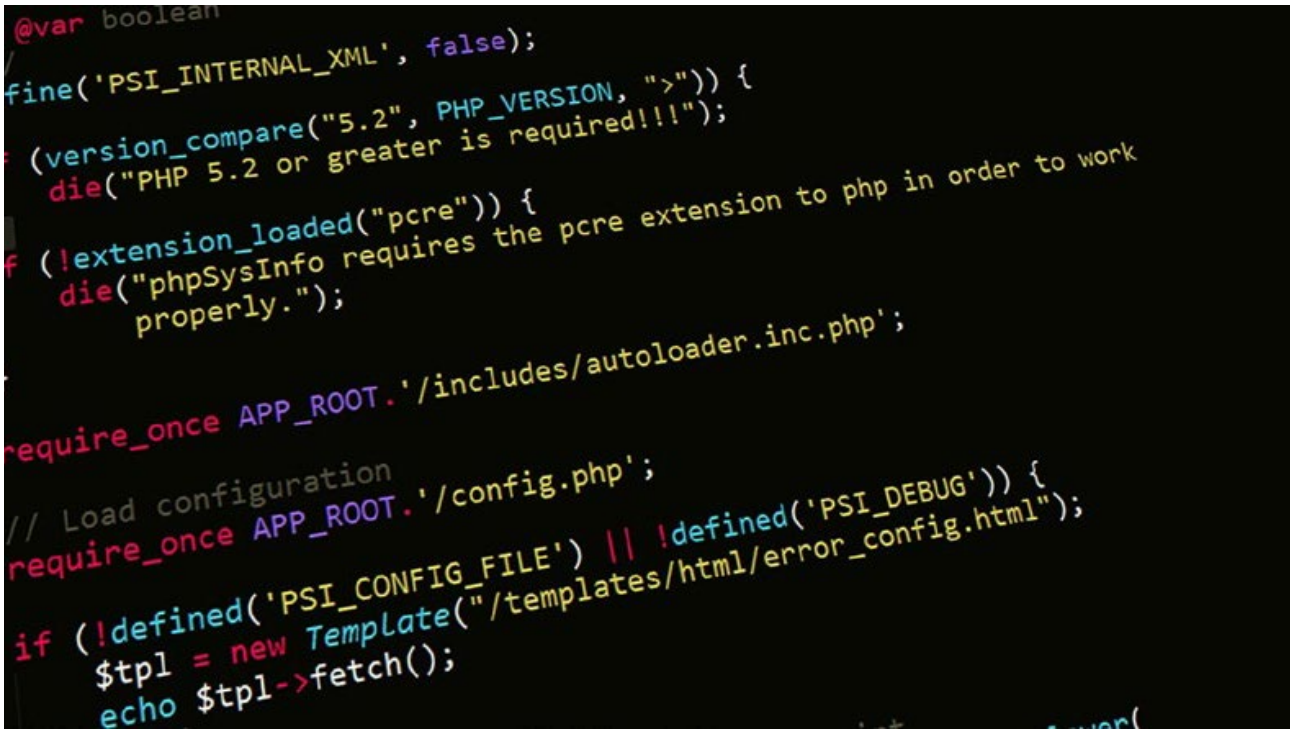
A single operating device for all control systems

The Windows 10 IoT Enterprise operating system and universal communication drivers for buttons and controls make it possible and increasingly simple to use different applications on the same mobile device (typically in sequence).

If both applications run for example in a browser, both can be displayed at the user interface. This makes it possible to use a single device for both applications without having to switch hardware. Certain controls such as the emergency stop button or the enabling device are always located in the same, familiar spot. The machine slot recognition triggers the switch from application A to B.

After the mobile device has been plugged into machine A or B, this detection feature automatically tells the device where it is. The corresponding application is activated. This provides an easy, seamless transition for operators, who no longer have to select the current application.

Of course, it would be perfect if the development of the HMI did already take the user profile and requirements into consideration. Have the main trends in machine operation been taken into account? Does the HMI provide for easy, intuitive machine operation even for complex processes?



Communication of variables

Typically, each application already includes the matching driver for the relevant control system, but not the driver for the communication with the tactile control elements.

A solution – at least for the majority of control systems – is now provided by dedicated drivers such as Siemens S7, Beckhoff ADS, Modbus TCP, and OPC UA. This makes the use of a single device for all control systems a reality.

It is equally possible to run a larger application that also takes care of the communication of variables to the different control systems. The switching follows a similar method. The application pays attention to the slot recognition and then presents the appropriate matching part of the application to the operator and activates the appropriate communication driver for the control system.

Of course, the principles presented here also work for different applications of the same control systems. The range of usability is practically limitless.

Easy region-specific solutions

This solution offers substantial benefits in particular to customers who market their systems or machines with the same functionality worldwide but who (need to) provide regional adaptations of the control systems. Typically, the target region where the machine will be operated is a crucial factor with regard to the control system to be used; specifically, this is true for the US market.

There, customers frequently prefer the control systems from the locally dominant manufacturer. (This may be against the background of easier service and maintenance if personnel is relatively easy to find.) This forces the machine manufacturer to supply the machine to the first customer with control system A and to another customer with control system B, even though both machines have the same functionality.

As a result, an HMI application which provides the same functionality must be created and maintained in two systems (control systems A and B). The solution presented here makes this issue obsolete: The HMI application needs to created and maintained only once.

The same logic could be applied if, due to regional market requirements, the manufacturer chooses control systems from different manufacturers in the same region.

Fewer spare parts

There is another major benefit with regard to stocking spare parts. Machine operators do not need to keep spares of each machine HMI in stock, because the number of mobile HMI solutions is smaller. This translates into a reduced spare parts inventory, resulting in further cost savings and smaller space requirements.

A single user interface for machines and plants: **time for innovation**

A single HMI for multiple machines and systems allows operators to work multiple control systems without any cumbersome switching. At the same time, even veteran operators benefit from enhanced safety and can avoid potential mistakes.

A standard user interface for multiple machines thus has a positive and tangible effect on the interaction between humans and machines. For new employees or temp workers, less time needs to be spent on intensive training and instructions. And lastly, a standard HMI can save money by reducing the need for stocking spare parts.

Having just a single user interface for machines and systems is the core of a new operating philosophy. It enables firms to save time so they can concentrate on their own innovations. A new operating philosophy that also drives innovation in your own company. But be careful: You should proceed step by step when innovating – but steps that are too small slow down innovation.

HMI innovations

Why small steps rarely lead to success

We show six reasons why operating concepts are usually developed in small steps, making innovation almost impossible.

1

Fear of change:
Small steps are usually negligible

Users of machinery are open to changes – but usually only small ones. At the same time, an HMI must take their requirements into account, have an operating structure that's logical and intuitive, and should ideally function like the old one. But that won't work, so in this case small steps are no good because they won't support a fundamental new approach.

2

Modification instead of innovation:
Optimizing existing operating concepts is easier, but slows down innovation

Optimizing existing operating concepts is easier, but puts the brakes on innovation. Companies want development to be plannable in order to keep costs down. They shy away from the risk of taking new, radical approaches and prefer to rely on simply modifying existing systems. But this makes innovation more or less unfeasible.

3

Risk aversion:
Accepting failure emboldens change

To develop a genuine culture of innovation, we must be ready to accept failure so that we can learn from our mistakes. Because most companies aren't willing to take this risk, they miss out on the opportunity to change something.

4

Innovation is hindered by market pressure:
Bucking the trend can lead to success

The market requires a constant stream of new developments. Because attention is focused on modifying existing products to fulfill this demand, innovation is neglected. The concept of "user innovation" could provide a remedy.

5

Day-to-day business kills innovation:
Independent teams are more innovative

It's very difficult to develop new products in everyday business. There's a very high risk of new ideas and resources being sacrificed in favor of current projects. Development departments should therefore always work separately from daily business.

6

No money for small developments:
Change is brought about by standardized innovative concepts.

Customers aren't willing to pay for HMI developments if their added value is almost unnoticeable. The solution usually lies in a comprehensive approach that generates real added value by making innovative, far-reaching changes.

Solutions

6 deficits in the conceptualization of HMI for operating devices, and how to do better

When introducing a new HMI technology, the first step is to be willing to adopt innovative concepts. During the conceptual phase, it's just as important (if not more so) to lay down the exact sequence of individual steps as a source of guidance. In the next few sections, we'll look at possible snags and how they can be resolved.

Picture this: You get ready for work, pack up your things, put on your jacket and shoes, eat a snack, and last but not least, put on your socks. Sounds like a strange order? It is! Structures are not only important in everyday life, they also play a decisive role in the implementation of an HMI operating concept. Before you start thinking about the icon colors or the key arrangement, the HMI technology should first be established as a basis. Here you will find an overview of six typical „don'ts" you should avoid when designing your new generation of innovative mobile and stationary HMI operator interfaces.

1 You start with the visual HMI design – and everybody is an expert

In a large-scale project for the redevelopment of an operation device, many start with the tangible end product: We talk about the hardware, the user interface, optional buttons, multitouch, and even about the design and color of the icons. That is hardly surprising because when it comes to design, practically anybody who has ever held an operation device, perhaps just their smartphone, will have something to say.

However, sometimes it can be better if not everybody has something to say, and this is certainly the case when it comes to innovative concepts for machine operation. It's like with painting where the primer must always come first – for the HMI, this foundation is the operation concept on which the tangible end design will be created much later. The first step is to adhere to the correct structure and to clarify what the goals of the new HMI are, which features it must accommodate, and which technology specifications it must fulfill. This analysis is then used to derive the operation concept, taking the design aspects into consideration.

2 You stick with the tried-and-true and fail to ensure an open technology architecture

Are you an Android or an Apple person when choosing a smartphone, or is it just a question of "philosophy" like it is with operating systems?

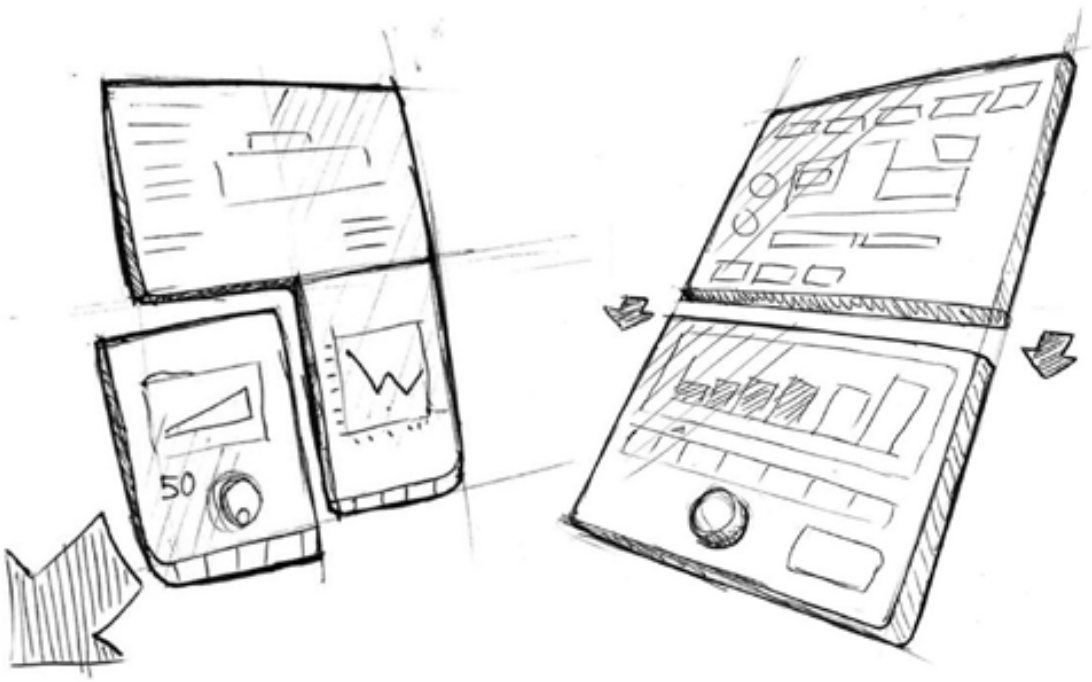
While that is how you might buy a new smartphone or laptop, the situation is not quite as simple when we're dealing with a new operating concept. The decision for the technology sets the course for future developments and forms the foundation for sustainable business models. This makes it all the more important for machine manufacturers to choose a platform that is open and modular and that allows them to develop future-proof, mutually compatible solutions.

Another important consideration is the support for various communication standards such as OPC UA in combination with established field bus systems like EtherCAT. There are numerous technical challenges, but the right HMI technologies and architecture can turn these challenges into new opportunities for machine manufacturers.

3 Your visual HMI design remains inflexible and you shy away from real change

Openness and flexibility are important not just for the technological foundation – they are also needed for the visual design. Here, it is important to consider all hardware and software components. Flexibility in your visual design opens up unconventional opportunities for the HMI experience. In addition, consistent screen resolutions and user interfaces on all devices and device sizes should be ensured.

You should have the courage to go for real change: If you would like to develop a mobile or stationary multitouch operation device, be bold and get rid of all those buttons. Sometimes it is necessary to throw out the old in order to spark real innovation. Sometimes small steps have a greater chance of achieving a successful HMI design.



4 You fail to create a detailed profile of the future HMI operator groups

The fish must like the bait, not the fisherman – that is a truism, and still, many companies struggle with putting themselves in the shoes of the customer, and even more so with putting themselves in the shoes of the end-user.

It is often a balancing act: Should manufacturers seek to realize their own ideas regarding features, design, and branding, or should they listen more actively to customers and translate what they hear into a corresponding solution? Not least due to the digitization of the consumer products market do many end-users expect to find the features that are familiar from the daily use of their devices – the swiping motion on smartphones, the real-time operation of apps, user-specific accounts, and constant availability on mobile devices. None of these features are innovative any longer; they have become the state of the art in machine operation.

This makes it all the more important to listen closely to the needs of the end customers, to focus on the HMI operator, and to speak the language of their industry. If the machine operators will watch tutorials and training videos, it would make sense to allow them to view these videos directly on the operation device.

If the end-users will primarily use functions that need a larger screen for efficient operation, it would make the most sense to switch from a mobile to a stationary operation device; if all desired functionality cannot fit on 10 inches and if mobility has low priority, then a stationary panel will be the better solution (for example for injection molding machines where the operators want to keep an eye on the mold at all times).

However, for users who need mobility and geographic flexibility, mobile devices must also meet standards with regard to ergonomics, safety, and accessibility, for example, right-handed and left-handed operation and wireless or wired options.

5 You develop a complex technology bundle even though the goal was an easy-to-use HMI

Both machine manufacturers and end-users want a user-friendly operation, but sometimes the end product is still a device that has been over-engineered because somehow, it needs to be able to do it all.

This well-intentioned bounty of functions and new features typically has an unintended result: The new HMI is suffering from feature creep and is anything but user-friendly. As a result, many more functions than originally intended are being added, which upsets the balance and the schedule of the HMI solution itself and also puts unnecessary stress on the entire project and development team.

These factors cause some HMI operation concepts to fail. For this reason, keep your focus on what is essential for the development of your new HMI, and stick to your concept and the targets derived from it.

6 You don’t listen closely to our employees during the HMI analysis process

You should listen closely not just to your customers and end-users but also to your own employees, in particular during the analysis process.

It is about looking toward the future together and about dealing with potential trends, requirements, and technologies. Each team member brings different qualifications and different perspectives and preferences to the table. There has to be a balance between the input from your own employees and the requirements voiced by your customers’ employees in order to make an efficient analysis of the situation and to work out an optimal, customer-specific solution.n.

It’s like it is with love: Many decisions depend on the right partner. So consider whether you want to realize your new operation concept under your own steam, or whether you want to take a partner along on the journey. If you decide you’d like a cooperation partner, then make a careful selection. Your project team is in the best position to assess with whom they can cooperate well and achieve innovative solutions.

Conclusio

Perform a thorough analysis of your new HMI concept and keep your focus on the end-user

Young machine operators today are used to the smart devices they use every day, such as smartphones with touch operation. Most users find such devices very easy to operate. Machine manufacturers must find a way to transfer this ease of use to the shop floor, in combination with ergonomic requirements. HMI users must be at the center of attention in order to reduce complexity and increase overall productivity.

To this end, it is essential to really understand this model user and to know how he acts on the shop floor, and why. A consistent HMI concept can be a crucial factor for a customer‘s decision in favor of your machine.

If you are planning your next-generation HMI for operating devices, it is worth taking a step back: Put your operation concept under the microscope; listen very closely to your employees; rely on an open, sustainable architecture; don‘t shy away from trying new things.

Devising the right concept and responding to users’ advice and arguments is one thing; choosing the right hardware is quite another. Operating devices used in industry often have to meet far higher demands than everyday smartphones and tablets. But what sorts of demands exactly? And what makes an operating device different?

Solutions

10 reasons why industrial operating devices are better than smartphones

Why use industrial panels when the in-house machine park could also be controlled via a corresponding app on a smartphone? This would be much more compact, lighter, and probably more popular with the operator at first. However, the widespread use of smartphones or tablets in the industrial environment is not yet given, although there are certainly some use cases in which consumer devices are capable of providing good services in the production process.

Here are ten good reasons why industrial panels are superior to consumer devices such as smartphones or tablets.

1 Operating devices are more robust than smartphones

Industrial panels aren't lifestyle products and are much tougher than tablets or smartphones. Their robustness is thoroughly tested before they're used.

2 Operating devices meet EMC requirements

EMC verification confirms an operating device's electromagnetic compatibility and ensures unwanted electrical interference can be ruled out. Consumer devices aren't subject to EMC guidelines.

3 Operating devices ensure safety

They have all relevant safety features such as emergency stop, an enabling switch, and an operating mode selector switch. Although smartphones and tablets could theoretically be retrofitted with these functions, the costs far outweigh the benefits.

4 Operating devices control machines quickly and reliably

A machine can only be safely controlled if the signal from the HMI is transmitted quickly and reliably. This precisely defined reaction time can't be guaranteed with smart devices.

5 Operating devices meet industrial ergonomic standards

A machine's HMI panel is subject to stricter ergonomic standards than tablets and smartphones. For example, using it mustn't cause fatigue, and it must ensure safety and efficiency at all times.

6 Operating devices can be operated non-visually

During robot teaching, for example, users must be able to rely on their sense of touch when using an HMI. The haptics of tactile buttons prevent errors and provide clear responses. Only industrial devices are designed to meet this requirement.

7 Operating devices are always compatible and can be used around the clock

Unlike smart devices, HMIs don't need to have their apps repeatedly updated, and they feature a universal operating system. In addition, their hardware and software are geared to the machine's continuous operation.

8 Operating devices don't overheat

Smartphones and tablets may overheat and switch off during continuous operation. Operating devices are built to withstand high requirements, which include temperature tolerance standards for industrial machines.

9 Operating devices meet industrial security standards

Cybersecurity requirements for machinery are higher in industry than in the private sector. They're intended to prevent hacker attacks and thus expensive machine outages.

10 Operating devices don't get stolen

Unlike expensive smartphones or tablets, hardly anyone will try to steal an industrial HMI for private use. An operating device is therefore always where it's supposed to be.

How-Not-To

The reasons HMI approaches fail and the lessons to be learned

At what point is an HMI successful in practice and also a real help for people to communicate successfully with machines, systems and devices and thus ensure an efficient and cost-effective manufacturing process? The greatest possible user-friendliness is the measure of all things here and decisive for the economic success of the HMI. In this chapter, we will therefore show you how not to do it, using a few examples – because we can also learn from flops.

Dual screen fails to achieve simplification: the smartphone Axon M

When the Chinese ZTE Corporation marketed a new product in 2017, it was anything but user-friendly. The idea of the dual screen of the Axon M smartphone was to provide greater convenience to users through an improved, larger display.

However, the gap between the two screens when held upright did not provide any benefits. On the contrary, the display on the dual screen wasn't more convenient, and it wasn't user-friendly. To make matters worse, the additional screen made the Axon M heavier than standard smartphones as well as relatively thick. The product had missed the mark.

Operator errors caused by touch screens at the US Navy

2017 saw one of the worst accidents at the US Navy. After multiple collisions with civilian vessels, a comprehensive investigation concluded that on the bridges of many US Navy vessels, crews were unable to cope with the operation of the touch screens. The ensuing operator errors cost several people their lives.

It was recognized that the touch screens for controlling the ships were far too complicated, resulting in an increased error rate when operated by the crews. The crew wished to return to classic operating controls like switches, dials and keyboards.

The following HMI issues may have played a role in these accidents:

// The input device doubles as the output device – important information may be hidden from sight by the hand making inputs.
// The screen does not provide any mechanical fixed points (unlike a switch, for example); in case of sudden movements, fingers can slide over the screen and trigger unintended actions.
// If fingers are wet or dirty, errors can be introduced during touch screen operation, or it may become impossible to operate the touch screen.
// The screen demands intense concentration on the part of the user because it realizes a broad range of different functions, and the positions for tapping can shift and move.

Nintendo: One of the first steps towards VR, which unfortunately failed

Those who were children in the 1980s or 1990s probably remember the NES (Nintendo Entertainment System) game console. But who remembers the Power Glove? It was a data glove worn on the right arm as controller. It used acoustic sensors to detect the player's movements.

We can certainly consider this glove one of the first steps towards virtual reality (VR) in the gaming industry, even though it failed to establish itself on the market. Just one year after its release, the product disappeared from store shelves.

This was not last due to the fact that it was programmed for just two video games, which didn't allow it to reach the broad audience of NES users. The greatest problem, however, was the inadequate detection of the player's movements. This made game control too imprecise, effectively making the games impossible to play.

At the time, this was certainly fascinating and innovative for gamers. However, Nintendo with their video game know-how were not themselves involved in developing and marketing the Power Glove. Instead, this was done under license. The Power Glove was modeled on an existing glove, the Data Glove. However, the Nintendo product was a slimmed-down version of the technology to reduce costs. In other words, in order to save money, certain technology was not included that was already available in other products.

Nokia's attempt to combine a smartphone with a hand-held console

In the 2000s, Nokia was considered among the leading cell phone manufacturers. During that time period, many teenagers wanted to use both cell phones and Game Boys, so Nokia attempted to combine the two devices into one: the N-Gage. It was launched on the market in 2003 but removed from Western markets just two years later because it did not sell well enough. Did Nokia try to do too much with one product? The N-Gage had additional multi-player, internet and PDA (personal digital assistant) features. However, most users complained that the selection of games was too small, and that the smartphone was too difficult to operate. Nokia had to face the comparison with Nintendo's Game Boy, and it didn't measure up. For example, each time in order to insert a new game, the user had to remove the battery. Users were unhappy with how to use the telephone, because due to the position of the speaker and the microphone, you had to hold the narrow side of the device to your ear. People even came up with the term "side-talking." In spite of great public excitement prior to the product launch, the N-Gage did not become as successful as Nokia had hoped. In 2004, Nokia sold one million devices, falling well short of the sales target of six million. By 2007, three million devices had been sold.

HMI flops: What we can learn from these examples

What are the lessons to be learned from these examples? Value-for-money and reliability are certainly factors that play an important role; but great user-friendliness and simplicity are needed more than anything. What good is an inexpensive or well-thought-out product if its operation is clumsy, time-consuming and ineffective. Quality is certainly important; after all, customers are looking for value for their money.

The above examples show that in addition, an HMI device must quite simply be able to do its job. Because if a product combines too many features and none of them work quite right, the user will not perceive any added value and will prefer to fall back on the tried-and-true.

What else do these flops show us? For one thing that even big names such as the US Navy or Nintendo can take wrong decisions and experience failure. On the other hand, that such failures can frequently lead to something new and better, because without failure there is no advancement.

Ultimately, whether an HMI is user-friendly or not is decided by your employees. After all, they're the ones who have to use it. And they naturally want to be sure it can be operated intuitively, and thus efficiently. Wouldn't it be better if the software were partly developed in-house, as this would allow the firm to have a say in the technology's design and architecture?

Digital world of interaction

6 tips for a successful HMI software design

If you are planning the next innovation in your production, it is worthwhile several times to subject the development of future human machine interfaces to a detailed analysis. In the case of a machine, pure component control is no longer sufficient. It should also provide extensive data. However, this data must be available to the operator in such a way that he can optimize production and performance during monitoring and analysis.

Operators of the younger generation are used to consumer devices. But how do you create an intuitive and simple machine operation for complex operations that also meets the needs of these operators?

The profile of the operator thus comes to the fore – who is the person at the machine, how does he work and what is important to him? Which key operating trends need to be taken into account? A well thought-out HMI design can be the deciding factor in whether an industrial machine buyer chooses your product.

We have compiled six tips for you to consider in the design process of an improved HMI. This will help you create a unique user experience and clearly set you apart from the competition.

Tip 1: Listen closely to your in-house teams during the analysis process.

Your software and electronics teams work closely with your customers. They are familiar with the requirements and challenges of day-to-day work and can contribute valuable knowledge to the analysis process.

A solid HMI concept has the end users in mind. It is tailored to their requirements, tasks and their work environment. Your in-house teams are familiar with the valuable experiences and feedback from a variety of user groups.

They know what is important for each type of user: Where do they need an at-a-glance overview? What relevant figures and information do they need to access quickly? Which features make their day-to-day work easier?

These answers and many more should be included in the design process from the outset. This will lead to solutions that enhance the user satisfaction in the long term, and in turn achieve higher productivity.

Tip 2: Use the services of an external UX designer.

In HMI software design, it pays off to think intensely and comprehensively about the architecture before starting on the implementation. Bring a user experience designer on board who will support you, your team and the process right from the start.

A UX partner is familiar with the latest hardware on the market and all its special features such as wireless technology, force feedback or haptic input elements. Aesthetics are as important as the look and feel, the screen quality, thought-out color schemes for color hues and intuitive navigation.

He will work with you not just in considering the user interface application or software but also the entire HMI including all its physical buttons and controls.

He moderates the process and provides the structure. What is important: It's all about listening. This process results in a consensus which in turn creates clear requirements for your developers.

If you cut corners here, you end up losing in more ways than one: You will fail to provide your machine with a unique user experience, and you will pass up on an excellent USP opportunity.

Tip 3: Create a detailed profile of the target group of operators.

When a customer starts an analysis process, the following scenario often plays out: There are two very different groups of users. The first group includes the old-timers – employees with many years of technical experience. They know the existing applications inside out and know how to get every last bit of performance out of the machine.

The other group are mostly younger operators, frequently temporary workers providing unskilled labor in production. They must be able to quickly grasp the state that a machine is in so that they can take the appropriate action.

Frequently, heated discussions ensue about what the future user interface should look like. Should it be a sophisticated interface with many detailed settings for the experts? Or rather a simplified interface with just a few settings and a streamlined design?

The answer: Both groups are right. But they are revealing different use cases that both apply to the machine.

The crucial question is this: Who will ultimately operate the machine, and for what purpose will they use the operator application?

While the machine is producing, somebody must monitor it and must be able to view the important information in an easy-to-read format even from a distance. But if the machine needs to be set up, or the process needs to optimized, or diagnostics need to be run – then an expert needs access to the whole range of functionality of the user interface.

Tip 4: Maintain independence from your ux designer.

At the start of the project, you can temporarily use additional resources for implementations, be they in-house resources or purchased resources. Keep in mind, though: Such additional services come with start and end dates.

So you must maintain your independence. Remain in the driver's seat of the development of your visualization application. As soon as the customization or maintenance stage starts, the project should be managed entirely in-house and no longer depend on any third parties.

Tip 5: Keep the architecture open.

Check thoroughly whether the technologies used are freely programmable so that the system will really be without any barriers. Avoid vendor lock-in.

Invest in a flexible framework that will still work later, when the application is growing or needs to be adapted to different machine types or customer requirements. A common code base is extremely important – it can continue to develop and evolve and integrate seamlessly into modern CI/CD processes.

Tip 6: Keep your visual design flexible.

Today's state of the art includes the option of making the visual design of the application independent of the functionality. This allows for a retroactive expansion of the application's functionality without having to take the style guide into particular consideration. It is predefined through cascading style sheets (CSS), which guarantees that the result always has the desired look.

> “ The decisive factor for a successful HMI design is who will operate the machine and what the operating application will be used for.

Conclusion: Successful HMI design

At the beginning, remember: It's all about listening. Listen carefully, both internally and externally. Create personas: The decisive factor for a successful HMI design is who will ultimately operate the machine and what the operating application will be used for. External partners can support you in implementing the new operating concept. However, keep your independence – later further developments should be able to be handled by the internal team. An open software architecture is therefore of great importance. Make the visual design of the application independent of the function. This way, you can easily implement important enhancements in the future.

UX Design

How to create a corporate HMI that strengthens your brand

Form follows function. Implementing your own operating concept boils down to this clear, unmistakable approach to design. A consistent design creates confidence and trust in the use of your corporate HMIs. This guide will show you how to strengthen your brand in the market thanks to a consistently implemented HMI design.

UX design from head to toe

The corporate design embodies the essence of the company. It shows up not only in public appearances or marketing materials, it also characterizes the entire product design. And good products need a carefully thought-out user experience design (UX design). Designers analyze and optimize the user experience.

They capture the entire user experience including users' thoughts, emotions and needs while they operate the system. Because users associate all of these things with the brand, the corporate HMI and ultimately with the machine.

For this reason, you should leave nothing to chance when it comes to the look & feel, in particular in mechanical engineering. UX designers aim to improve the user experience. Complex systems should be represented in a simple manner. Users should be enabled to complete their tasks at the machine as quickly and conveniently as possible.

Form follows function

UX designers focus on more than functionality. They provide the machine and its operation with an unmistakable feel. This in turn underscores the most important function of the product. Unmistakable design elements and operation controls instantly reveal the association with a specific brand.

Your corporate HMI design answers questions such as: Do you use it to monitor, operate and analyze a single machine or an entire system? How ergonomic, robust and intuitive is the operation of the panel? Who will operate the machine? Which is more suitable, a stationary or a mobile panel? What safety features should it have?

Apply the 'form follows function' principle to your HMI, too—define your own corporate panel with your individual corporate user interface. It completes the design of your machine and rounds out the brand experience.

Consistent HMI design builds trust

All successful products have one thing in common: Their consistent and solid design and functionality set them apart from the competition in a very real way. The significant added value for different user groups builds trust, allowing you to generate loyal fans of your brand.

This is the very thing that is often overlooked in corporate HMI approaches on the market. Don't trip up by attempting to improve your corporate HMI 'just a little bit'. Time and again, many fail because they are not rigorous enough in the implementation of their design. Focus on the big picture right from the start.

Achieving success depends on uncompromising consistency: Your manual is great, but working the machine is complicated. Your design is appealing, but navigating the user interface involves long waiting periods. Or perhaps your sales brochures are in top shape, but the cumbersome configuration tool for placing an order is highly frustrating. Such contradictions cause irritation among users.

Thought-out corporate HMIs spark enthusiasm

Our society is shifting from a consumer culture towards an experience culture. Material desires move into the background—creating one's own experiences moves into the foreground. In the workplace in particular, this is becoming increasingly important with regard to employee motivation. Design can play a supporting role here.

Enthusiasm is an important keyword which by now has come to the attention of many UX designers, too. Is the operation of the machine logical and intuitive? Does it foster the employees' own initiative? For example, are operators themselves able to analyze when certain machine parts need to be replaced or where settings could be modified to improve productivity? Are they allowed to apply their own thinking skills? Does it make them enthusiastic about what they are doing?

Operating devices today are no longer just about working the machine—users also keep the production process running and take an active role in shaping it: They install and interact with the machine, engage in production planning, analyze the overall system effectiveness, perform safety monitoring, etc.

One solution for many use cases

On the shop floor, we frequently find different operating devices for different machine types. Do we really need different screen diagonals, multiple variations of the home screens, or a smaller display for smaller machines? Don't shy away from questioning the status quo of your own HMI. Put your operation philosophy under the microscope.

Create a design that can handle as many use cases as possible, and take future developments into account today. The ideal corporate design concept ensures that the user interface operation philosophy is transferable from device to device and across all systems and machines.

Regardless of whether someone is looking at a 10-inch display or at a tablet, the user interface must show instantly that this is your product. The user interface turns into a product that strengthens your brand. Users always find themselves in a recognizable, familiar environment—regardless of the operating devices, they are using.

Seeing the big picture of HMI development also has an impact on costs. With time, hardware costs begin to move into the background because the hardware becomes heavily standardized. The expenses for the design and programming of a good user interface, on the other hand, skyrocket. Custom requirements are typically satisfied in the software, and people, in general, expect more and more of good UX design, thanks to trailblazers like Apple, Google, and others.

Be consistent and settle on one device size or type of hardware. Focus your energy on understanding the commonalities of different machine types and their users—not on the things that make them different.

HMIs should be independent of control systems

How can a single corporate HMI become attractive to multiple industries? One important issue is support for different makes of control systems. In other words, the HMI must be independent of the control system.

This can be achieved by using a middleware that contains an abstraction model of the machine. This can be cost-effective in particular with a view towards the standardization of machines for networking for I4.0 tasks. If the access, the HMI, the interface or the API—in other words, the machine architecture—is service-oriented, this compatibility pays off both for proprietary and third-party products that will be networked. A classic win-win situation.

Logical continuation of corporate design

Once you have mastered the last two items, this opens up the perspective of creating an ecosystem of software products that are independent of the hardware. From your own visualization that you can use on all of your own machines to web-based visualization for smartphones, simulation aids, analysis and optimization tools, M2M communication, MES integration, service portals and cloud integration. Done.

A strong HMI for a strong brand

Less hardware diversity and a clearly structured, service-oriented architecture—including control system independence if needed—form the basis for creating your own corporate HMI. Ultimately, this will turn your customers into proud fans of your brand.

Summary

In order for a interface between human and machine to function smoothly, a firm needs bespoke HMI technology. Aspects that need to be taken into account include users' requirements, an open technology architecture, and flexible design and development. Both hardware and software must comply with industrial standards. HMI devices can't simply be replaced by tablets or smartphones. An HMI's user-friendliness is key to its development and design.

The software should be intuitive so that it can be used effectively and efficiently, and the UX design must be open to development. Form follows function, and consistent HMI design creates confidence, strengthening your brand in the market.

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