# THE MODERN HMI IN EVERYDAY USE

Benefits of a web-based HMI solution in the application

Bachmann electronic is launching a new visualization technology for its controller system that is causing a rethink in the machine and system building sector. The purely web-based product solution makes HMI applications for Bachmann controller systems accessible from any location for the first time and via all mobile terminals.
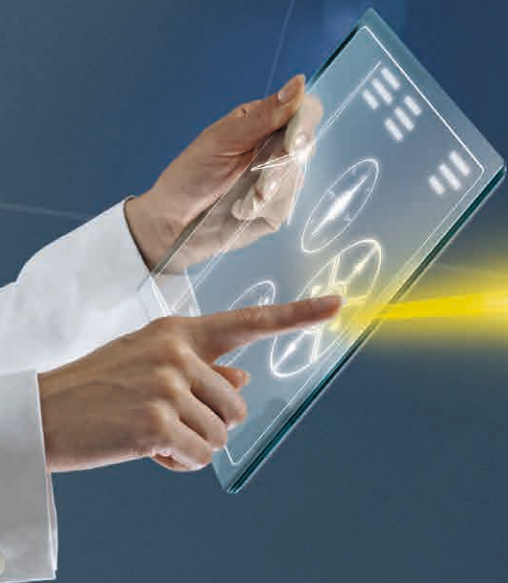
M1 webMI pro has already been tried and tested in the first practical applications for different automation sectors. This article describes the features and modifications in the new web visualization and the experience that users from three completely different automation sectors have had with it to date.

HMI for propulsion control in river cruisers

The new web visualization from Bachmann electronic is already being used in different automation sectors. This is how a technical developer of propulsion controls for river cruisers describes his experience with different visualization solutions and particularly with M1 webMI pro. Short background information about propulsion control: Large cruise ships today are mostly fitted with three to four propulsion units. This in turn normally consists of several rudder propellers that can be rotated around 360° as well as a diesel engine. Each unit is provided with a controller on which several processes are run independently of each other. These include the conventional propulsion control system, which in simple terms involves the fixed setting of certain rudder angles and speed settings, but which also includes other functions that are integrated in the automation process and on the controller. For example, this could be the automatic regulation of rotation speed around the vertical axis of the ship, as well as the maintenance of a fixed course and the provision of important information for engine monitoring, remote monitoring or GPS data. All tasks that are integrated on the controller naturally have to be included in the development of the visualization solution and implemented.

Disadvantages of conventional visualization solutions

The technical developer has already implemented product solutions for all of the described tasks and has gained a lot of experience with different graphical user interfaces. Even when he primarily used platform-independent solutions, they all reached their limits with iOS and Android. As shipping companies increasingly express the wish to use smartphones or tablets as terminal devices, the user thinks these solutions require a great deal of optimization. The same goes for the loss-free scalability of graphics. Standard HMI graphics applications continue to use raster graphics, in which scaling involves a considerable loss in quality. As panel sizes often vary in practice, it is difficult to exclude aliasing effects with the current state of the art.

The developer also places great value in the programmability of the user interface. Something that is provided with some widely used visualization products, but which often requires specific programming skills and is therefore only of limited benefit to many users.

webMI on its maiden voyage

According to the user, the Bachmann web solution provides all the features needed to optimally meet the visualization requirements of today's shipping. The vector graphics enhance the quality of the user interface considerably. What was previously displayed with simple arrow symbols can now be displayed ▶▶

▶▶ considerably more realistically, for example, using the image of a propeller. Even with small display devices, such as smartphones, the loss-free zooming without any aliasing effects ensures high quality visualization results. The user also considers the simple programming with direct storing on the controller as an enormous benefit. Thanks to the open hardware interface directly on the controller, new variables such as a new alarm variable in the alarm system can be added and completed from any location. Any additional input or modification to the visualization screen itself is unnecessary and is accepted automatically.

Another benefit is the new integration facility for already available map material. Navigation via GPS is an indispensable part of the visualization application, since shipping companies want to know the actual position of their ship at any time. Location displays, which previously required a major effort to implement, can now be integrated really easily via open web technologies such as Google Maps. Permanently updated map material and frameworks to display the GPS information on the map also considerably simplify project design.

HMI for silo filling and emptying control system
A manufacturer of automation solutions for the EPS industry reported his positive experience with M1 webMI pro to date. Bead foams such as polystyrene are primarily used in building insulation, in the packaging industry and in the automotive sector. The manufacturing process in short: To produce bead foams, the bead granulate is first of all brought to a specific particle size and then welded into a molded part using steam. During this manufacturing process the granulate beads are conveyed in silo bags and stored via a pipe system. The following application example of M1 webMI pro refers to the visualization of precisely this production step. The user develops control solutions for the automated filling and emptying of the silo plants.

Disadvantages of conventional visualization solutions
The individual silos, which are often located at a great distance apart in the production facilities, are controlled a network. This means that they operate as part of a single overall plant and therefore have to be represented accordingly in an overall HMI solution. In conventional visualization systems, the HMI was usually located in a control cabinet at the beginning of the production chain, i.e. at a considerable distance from the individual units. This spatial separation naturally had an effect on plant operation as well as commissioning and troubleshooting. In order to operate the overall plant, which primarily involves the opening of silo flaps and particular port settings, individual silo data, such as volumetric weight, storage time or material type, had to be accessed locally at the particular silo beforehand. In the next operating step, the recorded data was then entered manually in the HMI system at the remotely located control cabinet. Using the method described

▼ **State-of-the-art visualization solution on an Apple iPad™:** HMI for propulsion controls on ships.
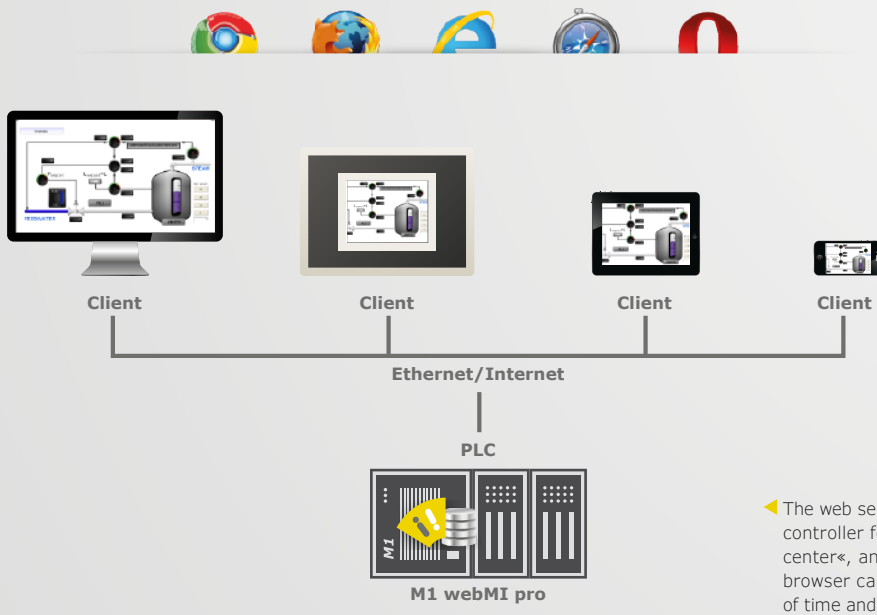
to detect any faults in the control process required more effort and mostly involved the deployment of several employees, since the fault source was often at the silo ten meters above the ground.

Requirements placed on a modern HMI solution

According to the user, mobility plays an indispensable part in order to overcome the spatial distance between silos and HMI, as well as the resulting effort required. The required mobility here refers equally to the querying of information as much it does to plant operation, commissioning and troubleshooting. Due to the increasing complexity of plants, it is also highly important to maintain an overview of the overall process at all times. A clear overall display of all silo control processes can make a considerable contribution here. The issue of flexibility is also becoming increasingly important today. Additional customer wishes are often not expressed until the system is in use. The ability to adjust the user interface quickly and simply to new requirements at a later time, i.e. during ongoing plant operation, is therefore even more important.

webMI pro in daily silo operation

The expert in silo plant controls considers that webMI pro more than fulfills the relevant requirements. He describes the convenient facility for entering target production data directly from the office as one example of user-friendly mobile operation. Troubleshooting can now be carried out locally at the fault source by a single person, who can record and rectify the problem using a mobile terminal, such as a smartphone.

The plant expert praises in particular the object-oriented programming, which saves a considerable amount of work for the manufacturer. The time required for project design, which with a conventional visualization previously took up virtually 70 percent of the overall project, is now reduced to a minimum by eliminating any redundant project design work. Variables are created once on the PLC and automatically assigned for all instances of objects. This also simplifies the later adaption of the running system. An onsite validation in the restricted and noisy environment of the plant in operation is no longer required, but can be carried out conveniently from the office. M1 webMI pro enables programmed detailed displays of individual silos to be transferred to the overall display and accessed from any location. The benefits described have impressed the user so much that he intends to convert all automation solutions to the new web-based HMI system in the medium and long term.

HMI for CHP units

The third report on the new Bachmann visualization system comes from a user from the renewable energy sector, in the specific field of energy production from biogas. The long-standing business partner of Bachmann electronic manufactures state-of-the-art combined heat and power units. The standard product program ranges in output from 50 kW to 2 MW and is suitable for operation both with biogas and natural gas.

Combined heat and power units (CHP units) are the only generator systems to offer the combined benefit of simultaneous electricity and heat generation. Plant operators, who mainly come from the agricultural sector, are thus able to implement an autonomous power supply and to secure the running of their business in times of severe power fluctuations. Furthermore, they can ▶▶

▲ The power plant can be accessed from anywhere in the world.

▶▶ also feed the thermal energy produced into a utility grid and benefit financially from an additional income source.

Requirements placed on a modern HMI solution

Due the demand-based electricity generation – the CHP unit running continuously one day, and only for a few hours or not at all on the next – the plant has to be well-prepared for so-called intermittent operation. Pre-planned startups using configurable startup programs, as well as direct access via remote startup and control functions are indispensable. The CHP unit also needs to have a robust startup behavior since 300 start operations per year are not uncommon. These requirements naturally also apply to the operation and visualization processes on the generator, since rapid information queries and direct interventions must be possible at any time. A basic requirement here is a clear and ergonomic user interface. As plant operators consist of very different user groups – some plant operators, mostly farmers, use the biogas plant primarily as an autonomous power supply, whilst other operators use the CHP unit commercially and therefore require information in considerable detail – the range of accessible parameters and processes in the HMI solution must ideally meet the specific requirements of the customer.

Whilst these user profiles are varied, most biogas plant operators belong to a younger target group that are used to handling the latest communication media. They accordingly expect a high level of state-of-the-art operating options. Mobility is therefore playing an increasingly important role also in this automation sector.

Disadvantages of conventional visualization solutions

Biogas plants are mostly remotely located outside in the field. In the event of malfunctions, operators using stationary HMI devices have to travel out each time in order to identify the fault. This is made more difficult by the fact that these situations often occur in the middle of the night.

The location of the plant also places particular requirements on the properties of the operating terminal. A high exposure to dust and dirt requires a robust design and makes the operation of the latest touch screen devices more difficult if they are to withstand harsh environmental conditions over the long term. A reliable product solution for this can be very expensive.

M1 webMI pro in the field

With this application example, the benefits of mobile visualization are clear to see. The plant operator can call up all parameters from his current location via a mobile terminal, see if everything is OK, and restart the plant

if necessary. He then only has to be really on site when there is a »genuine« fault. This considerably reduces any unnecessary maintenance work. The investment outlay for a high-end terminal at the plant is like-wise unnecessary.

The sector expert also appreciates the high degree of flexibility that M1 webMI pro offers for visualization on a wide range of different terminals. A reduced display on a small smartphone display can be imple-mented just as well as a detailed overview on a large display with several information levels. The solution supplier can thus tailor each visualization produced to individual requirements.

The modern user interface with top quality graphics, even with zoom and move func-tions, as well as the simple use of gesture control »out of the box«, meets all the requirements of the younger target group in terms of operation. According to the CHP expert, the special benefit of M1 webMI pro for manufacturers is the ability to reuse objects that have been already created, the programming ability and simple project design for all visualization devices.

Outlook
In summary, it can be said that all reports on the M1 webMI pro have been extremely positive. Any difficulties and improvement

suggestions have not been reported from practical applications.

Even if the requirements profiles differ between sectors, all three experts cite the mobile operation and troubleshooting fea-tures, as well as the possibility for individual visualization designs, as the main reasons for the positive reception. The first feature is not only regarded as a way of significantly increasing ergonomic operation but also as a way to achieve long-term cost savings. Traveling distances for acquiring data at a plant as well as the transfer of information to the control center are eliminated, thus enabling the workforce on site to be used considerably more efficiently. The issue of improved efficiency continues to be a hot topic in the automation world, and it can be assumed that nothing will change here in the coming years – quite the opposite.

What also enables the users to face the future with confidence is the use of open and widely used Internet-based technologies with which M1 webMI pro can easily »grow« as these technologies develop further.

Due to its wide range of benefits for industry, both Bachmann electronic and also the experts from the case studies described are convinced that web-based HMI will gain in popularity in the long term and set the general technology standard.