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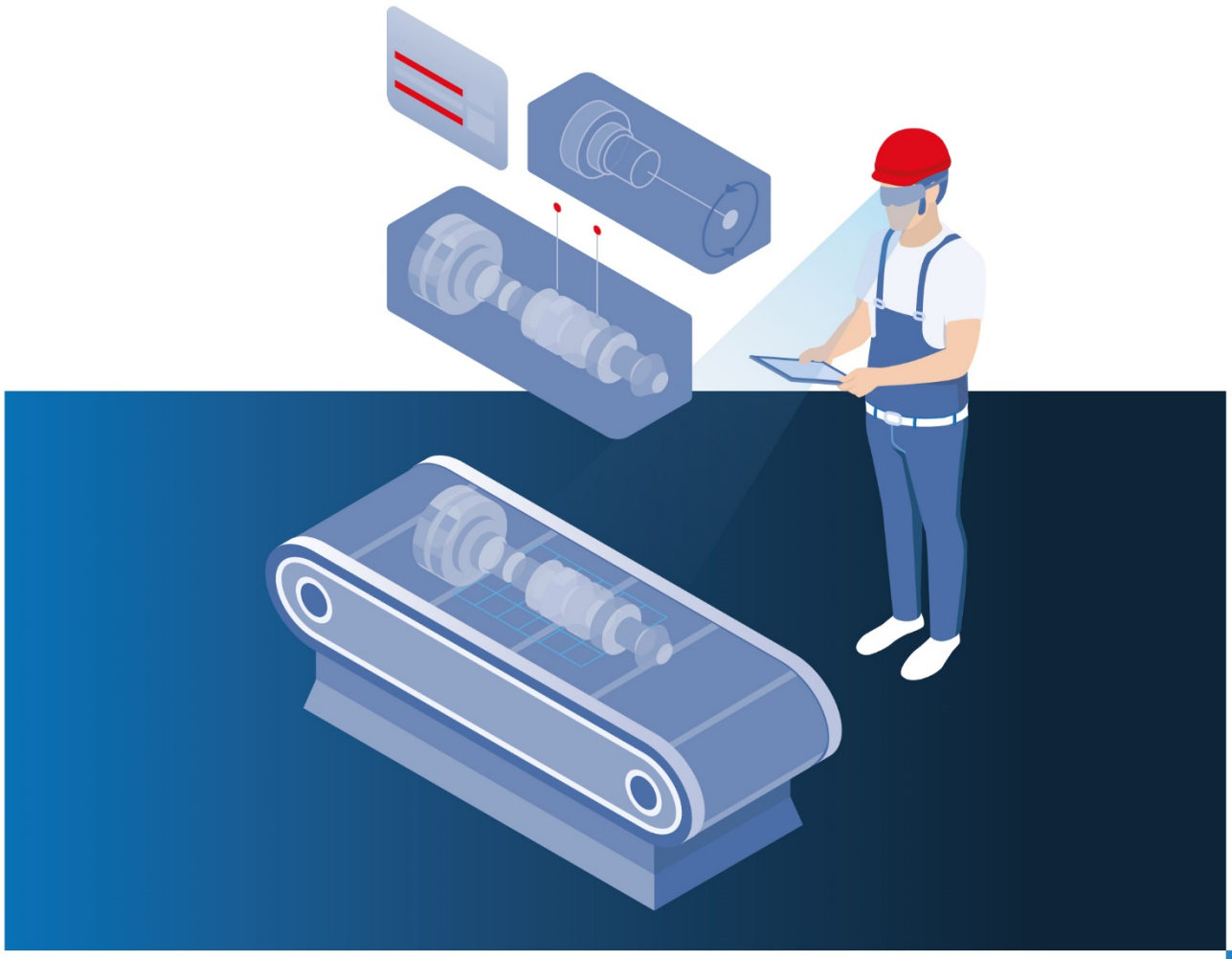
White Paper



Augmented reality
whit Movicon.NExT™

Modern technology offers possibilities that can redefine the approach to managing the man-machine interface. Wearable Augmented Reality technology makes it possible to employ solutions that until recently were considered as science fiction.

Augmented Reality – or AR – technology has been introduced for enhancing the human sensorial experience, or for complementing a person's environment with electronic information, through audio-visual information provided electronically by the use electronic or IT devices.

Therefore, by using Augmented Reality it is possible to add information in real time to the surrounding environment, which proves extremely helpful in evaluating circumstance in order to consistently make the best decisions.
Augmented Reality can be used in several different ways. Up to some time ago, AR

applications were mostly used with Smartphones or Tablets, where images captured through the integrated webcam could be enhanced with electronic information based on specific needs, and on geographic positioning.
Now the introduction of wearable devices brings about new operational possibilities, as the application range of these solutions broadens.
In this document, we shall disregard any possibilities offered by Augmented Reality for personal, home or entertainment applications. Instead, we shall focus on how which Augmented Reality can redefine the approach to running machines and plants in the industrial context.

Augmented Reality in the Industrial context

The use of Augmented Reality solutions in industrial contexts has been growing significantly in latest years, thanks to the evolution of this technology especially in the area of wearable electronic devices.
Indeed, the crucial added value in an industrial context consists in allowing the operator to freely move and use his/her hands, providing at the same time additional real-time information that is relevant to the operational context.
In such a case, wearable AR systems support and simplify operational activities, constituting an excellent solution that perfectly integrates with supervision and HMI technologies commonly used when managing automation systems and maintenance activities.

Augmented Reality is used in several manufacturing industries or in process control, where operators can use and integrate new systems with standard SCADA/HMI viewing tools to perform actions needed for the various process stages, improving production efficiency, reducing error risk and minimizing production or maintenance downtime.
Devices supplied to operators usually come in a kit: glasses or helmets fitted with displays, cameras, audio hardware, Wi-Fi connectivity and batteries for ensuring freedom and flexibility in the use of such devices.

For instance, these systems can display on the wearable screen dynamic, real-time information relevant to the context where the operator is working, as well as process operations, systems status, alert-related information, required actions or context help. At the same time, they can interpret the required commands, such as start, stop, set-point modification, instruction requests based on alerts, etc.
The handsfree use of these devices allows for a higher flexibility and speed during operational phases, impossible to match using standard HMI interface systems – which however the operator continues to use, as they are still available as workstation support for traditional work processes.

As concerns maintenance activity, Augmented Reality systems make it possible to focus on one's activities on the one hand, viewing on the screen the documentation about the part being maintained, and on the other hand to communicate handsfree with the operations center using the wireless connection. Consequently, the risk of error from inaccuracy or misplacement can be reduced significantly.

The various benefits of Augmented Reality include:

1. Viewing real-time information related to the automation system.
2. Viewing details on the required actions related to the operational context.
3. Alert notifications and relevant instructions.
4. HMI interactivity for vocal or gesture-based commands.
5. Guided maintenance and operation.
6. Barcode or QR Code scanning with real-time context-related feedback.
7. Connectivity and interaction with other operators at Remote Operations Centers.
8. Interactive – and/or holographic – 3D views of automation systems.
9. Access to information via the Web.

Applications described above are only some of the scenarios that could be used in an industrial context. In the near future, evolving technology will allow the creation of devices that are more and more accessible, powerful and function-rich, so that new, accessible solutions for meeting specific needs may come to light.

HMI redefined.

Augmented Reality is a brand new opportunity in the world of automation, and with the new wearable devices that are now available, its potential can redefine the operators' approach to managing production processes, allowing to increase productivity and reduce production downtime.

In fact, because the HMI can now be worn, the operator can keep processes constantly under control, and can act immediately and accurately based on the circumstance of the production process.

A scenario in which the operator speaks to a machine, asks for information, addresses commands or directly interacts with the system using hand motions to launch or adjust a process is no longer science fiction. Moreover, the machine may ask the operator to execute required commands or manual operations as required by the circumstance, guiding the operator in his/her activity, preventing any inaccuracy or lack of efficiency.
This constitutes a revolution in the domain of the Operator Interface, which will require a different approach in designing automation systems, so as to get the most out of this new potential.

Seeing things in a new way.

There can be several different types of Augmented Reality solutions, depending on hardware devices used, on the automation context and on project goals.

For an Augmented Reality project to be successful and translate into a significant productivity boost, project design of HMI systems must be viewed under a new light. It is necessary to assess how to adequately display information based on circumstance and on the wearable display's requirements, then to carefully select and position the right information, and also to manage the operator's interactivity according to the capabilities of the hardware used and to the operational context, evaluating the use of such add-ons as Text to Speech or Vocal Recognition.

Lastly, it should be considered that new technology offers stunning graphic performance, which is simply unimaginable with current HMI systems. More specifically, some devices can render 3D graphics and holograms of whole machines or machine parts, and when connected they can dynamically animate a 3D object based on real-time data.

Reality allows for new meanings of efficiency and man-machine interface in the industrial context.

Microsoft HoloLens

Microsoft HoloLens is a wearable holographic computer, although it is more commonly referred to as an Augmented Reality device, given its capability to overlay a virtual interface to the actual environment, so as to ensure remarkably intuitive interaction.

HoloLens includes a CPU (processor), a GPU (graphics unit) and a third chip called Holographic Processing Unit (HPU). HoloLens is a stand-alone device, i.e. it works autonomously: it needs no cables for connecting to PCs or other devices, which implies the use of a battery. Some prototypes are fitted with a power cable, however Microsoft's objective is to offer an unthetered product.

The display is actually a computer to be worn on the head with a transparent lens (which allows to see the surrounding environment), advanced sensors and surround audio (spatial sound) which allows to locate the sound source. Sensors include an inertia measurement, a light sensor and four cameras for environmental analysis. An additional camera can detect depth in order to recreate the surrounding environment, while a 2-megapixel HD camera is used for taking pictures and shooting video. Vocal commands are captured by four microphones embedded in the display. According to Microsoft, HoloLens can gather terabytes of data from sensors and process it in real time. The device senses where the operator is looking, interprets his/her gestures and understands his/her vocal commands.

HoloLens runs on Windows 10, the technology at the heart of Microsoft's most advanced operating system.

Movicon.NExT App for HoloLens

Progea's innovative HMI technology makes it possible to create HMI applications for HoloLens. In fact, Movicon.NExT SCADA/HMI platform is so incredibly scalable that it even supports Microsoft Win10 for Hololens. It is therefore possible to create Movicon.NExT HMI applications, complete with synoptic tables, symbols, highest-quality graphic objects, also using 3D technology. In fact, Progea is currently working on adding 3D technology to the App for HoloLens, employing the functions of an advanced supervisor unit and exploiting the holographic capabilities of the device, for an HMI experience beyond compare.

HMI graphics are processed and displayed by the App in HoloLens' CPU, which can also process local data.

Connectivity to Movicon.NExT's SCADA Data Server is ensured by a Wi-Fi connection, using OPC UA as the open system for connectivity. That is not all. HoloLens can also be used as a stand-alone processing unit, as an AR device connected to the Web with Industrial Internet of Things (IIoT) solutions, using such protocols as PubNub or MQTT.

Movicon.NExT Web Client for HoloLens

HoloLens also allows viewing HTML5 webpages, employing the system as a browser and using Movicon.NExT's Web Client technology. In such a scenario, the Augmented Reality system uses Web architecture to display the graphic pages of SCADA Server's synoptic tables.

Smart Glasses

The term ‘Smart Glasses’ is used to define a type of Augmented Reality wearable device which has the shape of and is worn like a pair of glasses. Visual content and dynamic data are viewed on a ‘head up’ display which overlays information on what is being looked at. Several devices are available on the market. The following are the most widespread ones, and have been tested by Progea.

Google Glass

Google Glass has been the most talked about wearable device. Developers are given the option to purchase a test model along with the Standard Development Kit (SDK) based on Android 4, required for developing individual applications. This device offers several additional functions thanks to the integration of camera, inertia sensors, speakers and microphone, used for controlling Google Glass via vocal commands. It constitutes a real stand-alone wearable device, in that the application can be displayed directly on the glass and does not need any other external device. The product is still being tested, as Google is making hardware changes based on the user feedback.

Epson Moverio

Epson markets Moverio devices, glasses designed for use in Augmented Reality (AR) contexts. In this type of application, these devices boast top performance: image resolution is much higher than that of the average product, and the image is displayed for both eyes. For this product too, an Android 4-based SDK is available for creating applications which can also be published on a specific Epson Store.

Moverio BT-200 is available on the market at about EUR 600, however the BT-300 will be coming soon, which at a slightly higher price offers very interesting features: the use of innovative OLED (Organic Light Emitting Diode) digital display technology makes it the lightest transparent-lens binocular device on the market, boasting an unprecedented image quality. The Augmented Reality experience can really become fascinating, also thanks to HD resolution, high contrast images.

Beside the exceptional graphics quality, including 3D functionality, Moverio sports a front HD camera for shooting video, and a battery ensuring six hours of operation.

The powerful 1,44 GHz Intel® Atom™ x5 Quad Core CPU ensures top performance, even running complex, content-rich applications. Thanks to the number of sensors Moverio BT-300 is equipped with – including motion sensors integrated in the display and in the controller – plus GPS, microphone and video camera, it is possible to create highly sophisticated applications.

NExT App for Android Smartglass

Progea has designed an App for the Android operating system, specifically for viewing images and real-time data from Movicon.NExT's SCADA Data Server.

Application Server: Movicon.NExT SCADA/HMI

An Augmented Reality project must necessarily gather its dynamic data from a Data Server, i.e. an application that physically communicates with the system or the machine, therefore using suitable protocols for accessing data from monitoring devices such as PLCs, CNCs, Sensors, etc.

Consequently, a Server platform is needed to publish system-related data, and to make it available to the Augmented Reality device.

Most likely, however, the system needs a monitoring workstation that is disconnected from the Augmented Reality device. The supervision workstation (SCADA/HMI) manages all typical needs of such a system, i.e.:

1. I/O Data Server
2. Historicization of events and process-related data
3. Alert notification and event notification management
4. Data analysis management
5. Control logic management

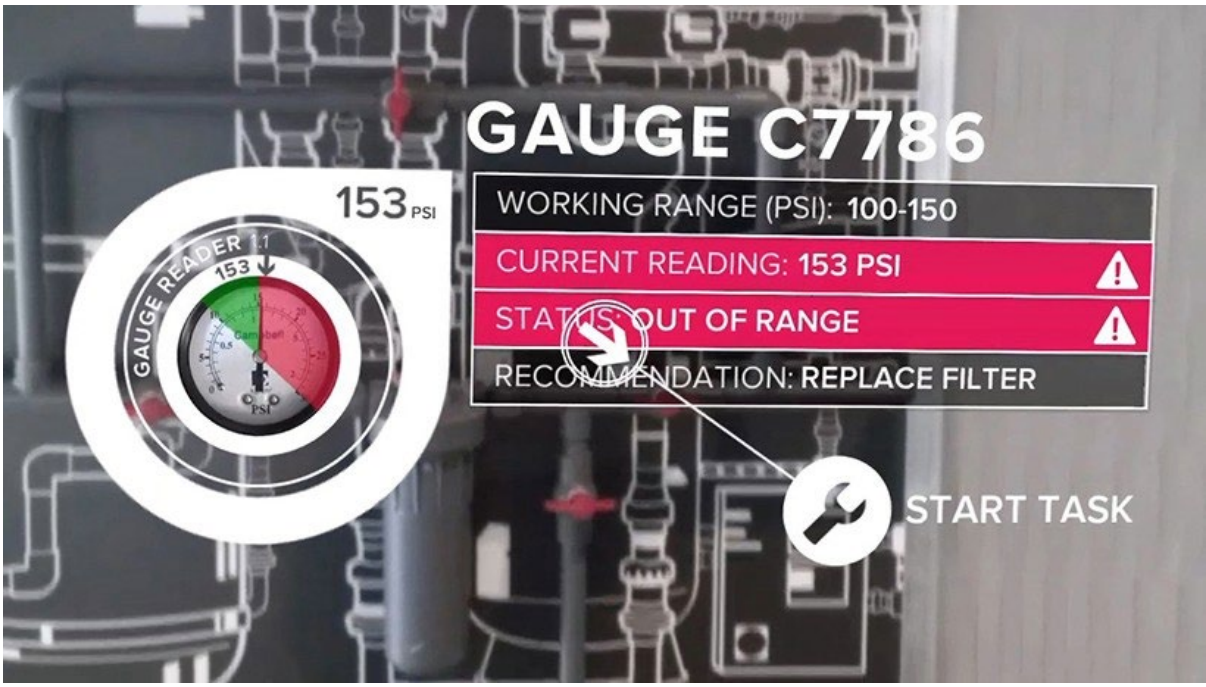
The Augmented Reality device should therefore be connected to the supervision system, or at least should be connected whenever system-related real-time data is available. Consequently, the Supervision System and the Augmented Reality system are strictly linked to one another. The ideal solution is a standard, open, user-friendly platform that is compatible with several field connectivity options using all industrial protocols, that is modular and expandable, and that includes all functions needed to design SCADA/HMI systems as well as Augmented Reality systems.

Movicon.NExT

Movicon.NExT is a new-generation SCADA/HMI platform, based on the most modern and innovative software technology. It is developed by Progea, a company that boasts 25 years of experience in software technologies applied to automation, specifically industrial automation and production and energy-saving efficiency. Its most widespread product is Movicon, which boasts over 100,000 applications worldwide. Movicon.NExT is based on the Platform.NExT Automation technology, a modular software solution, centered on a .NET framework especially developed by Progea for automation applications on PC-based architectures as well as on embedded systems.

The platform uses the OPC UA data transfer specification, so that it constitutes a modular, open platform linking Client modules and Server modules in the same framework.

Thanks to its modular approach and technology, it is the ideal solution for IIoT projects, which need to be inherently open and flexible.



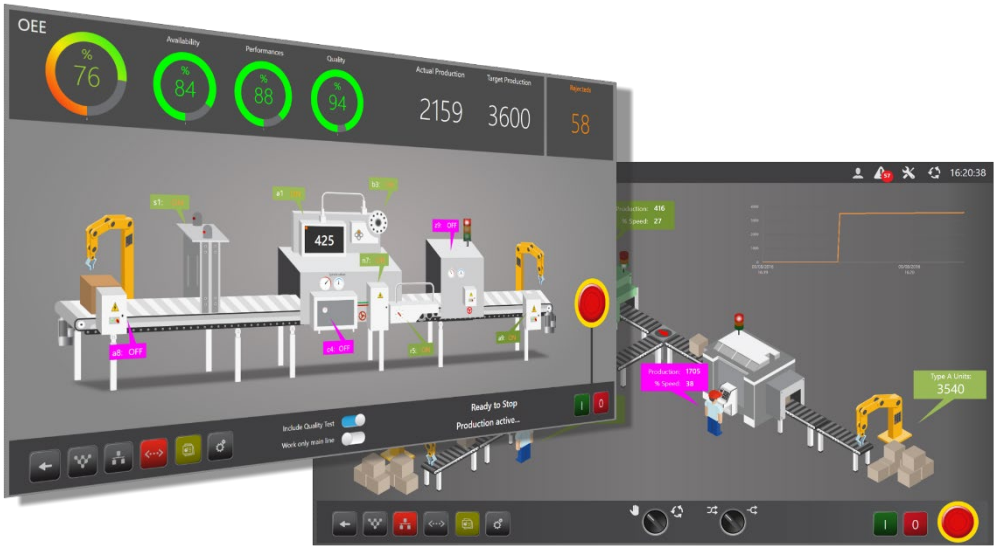
Example of Augmented Reality application where the display overlays dynamic data from the supervision system and the data server on the surrounding environment.

I/O Data Server

A good industrial supervision project starts by planning data gathering. That is why it is ideal to use a communication server like the one included in Movicon.NExT, which allows connecting to devices using protocols that are commonly used in automation, such as Modbus, Siemens, Rockwell, Schneider, Mitsubishi, Omron, Panasonic and many more, including Profinet, BACNet, Ethernet/IP, EtherCAT field buses etc.
Beside compatibility with protocols for automation devices, Movicon.NExT natively supports OPC UA connectivity, as the framework's data specification is based on the OPC UA type. As concerns the IIoT, Movicon.NExT's Server can connect to any device or application, even using PubNub or MQTT protocols, and it is compatible with Azure IoT's direct implementation.
In addition, the Server offers the most advanced and comprehensive functionalities for Alert Management and Historian Management, for logging data on a DB or on the Cloud.

New-generation HMI technology

In Movicon.NExT, data display technology is managed by the Client module, and runs all functions that are expected of a new-generation HMI. Graphic rendering is based on WPF (Windows Presentation Foundation), Microsoft's new-generation vector engine, which uses XAML-based vector graphic. This results in graphics of excellent quality irrespective of the screen resolution, even using 'pinch & zoom' functions so widely featured in modern multitouch systems – which by the way are fully supported.

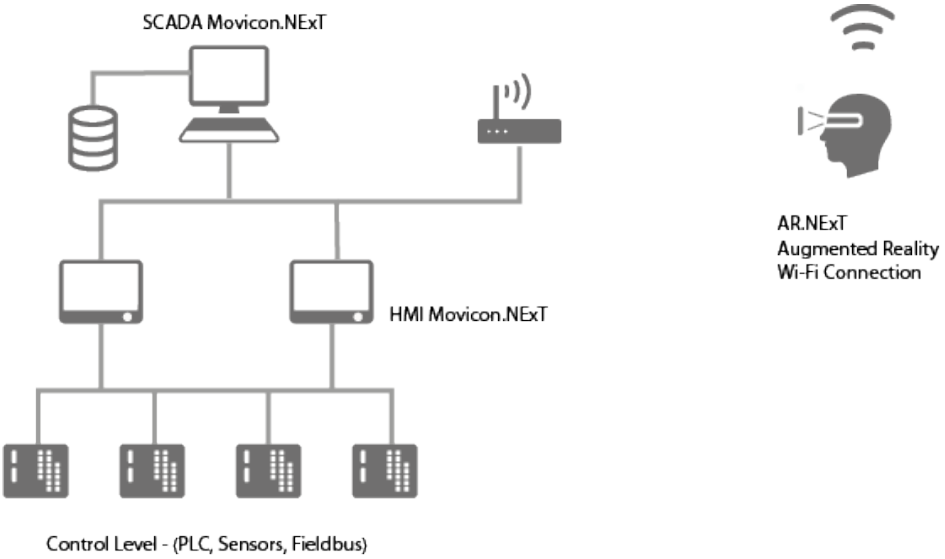


Generous libraries of symbols and objects – also latest generation – have been designed to support new graphic capabilities, and allow creating animated synoptic tables which use modern automation technology at its best. 3D graphics support, along with dynamic interactive functions over 3D elements or element groups, makes it possible to create HMI systems of the latest type, especially as concerns new holographic devices.

Lastly, graphic functions comprehensively support alerts and historical data analysis, using all common functions such as Trends, Graphs, Data Analysis as well as a powerful Report Designer.

NExT applications for AR devices

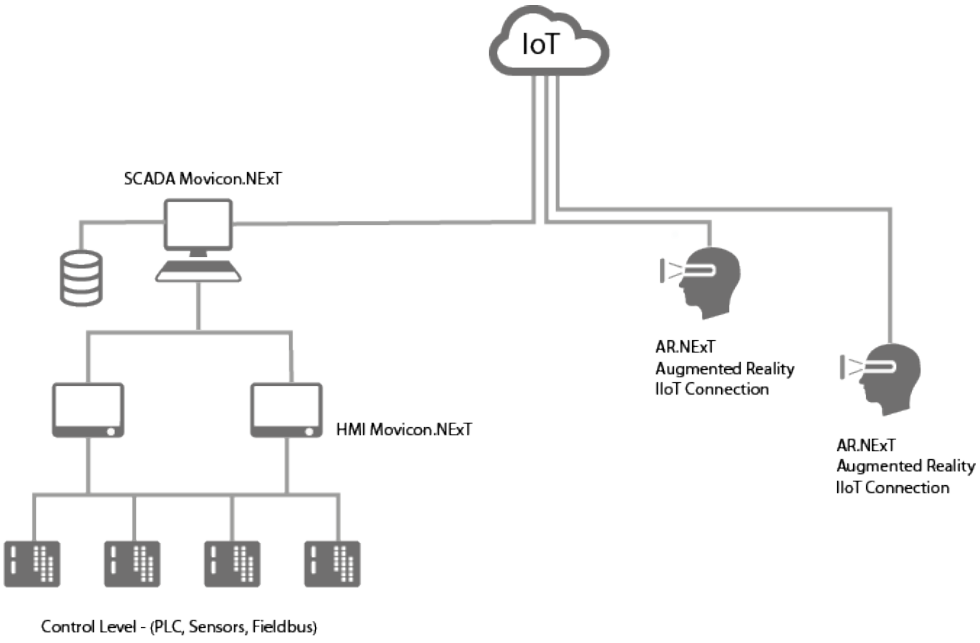
Google Glass was the first product to be tested by Progea with regard to Augmented Reality. Demo applications were presented to the audience at the latest automation trade shows, creating great interest.
In order to effectively design a project architecture that is compatible with Augmented Reality, Progea has developed Apps that can communicate with the Movicon.NExT supervisor Server, display content and interact with the system via the AR (Augmented Reality) device.



Example with Augmented Reality devices (Smartglass or Hololens) connected to systems via Wi-Fi network

To this end, an Android-based App is available, which can be run on the AR device's local CPU and, when connected to the Movicon.NExT supervisor, can display on the supervisor unit synoptic tables compatible with the device. Thus, it is necessary to outline a local AR project of sorts, for viewing specific data – for each page – in standard or custom mode, and for receiving commands to be forwarded to the supervisor by means of the interactive system fitted on the device.
Therefore, the system may be configured so that the user is able to freely create custom information and custom interactive functions with the supervisor. Of course, any specific customization and interaction request can be edited and integrated in a specific App

project, either autonomously (SDK) or with Progea's support, in order to meet any specific needs.
Subsequently, Microsoft announced the development of a new-generation AR device, the above-mentioned HoloLens. Progea immediately contacted Microsoft to be among the first to receive the trial Kit for this device which, as previously mentioned, is based on the Microsoft Windows 10 OS for HoloLens. Based on Progea's superior know-how on this operating system, along with Movicon.NExT technology's native integration of Windows functionalities, an App for Windows 10 HoloLens was designed for running projects created locally using Movicon.NExT. In the first release, Movicon.NExT's synoptic tables may be integrated – although without the use of 3D technology, which will be enabled with the next release of this Progea product. However, HMI projects for HoloLens may be created for connecting individual Tags over the network across devices or between supervisors, using both Wi-Fi connectivity and IIoT protocols. Thanks to its pointing technology and its holographic capabilities, HoloLens constitutes a true game changer, and can bring considerable added value to HMI solutions looking into the future.



Example with Augmented Reality devices (for Hololens only) connected to systems via IIoT

Visit our website:

http://www.progea.com

Progea Srl
Via D'Annunzio, 295
41123 Modena
Italy
Tel. +39 059 451060
Fax +39 059 451061
info@progea.com

Progea Deutschland GmbH
Marie-Curie-Str. 12
D-78048 VS-Villingen
Germany
Tel: +49 (0) 7721 / 99 838 0
Fax: +49 (0) 7721 / 99 838 11
info@progea.de

Progea International SA
Via Sottobisio, 28
6828 Balerna (CH)
Switzerland
Tel:+41 (91) 96 76 610
Fax +41 (91) 96 76 611
international@progea.com

Progea North America Corp.
2380 State Road 44, Suite C
US Branch Office
Oshkosh, WI 54904
Tel. +1 (888) 305-2999
Fax. +1 (920) 312-7789
info@progea.us