

A grayscale background image showing a person from behind, interacting with a large touch-screen kiosk. The kiosk displays a flight check-in interface with options like 'Check-in Procedures', 'Boarding Pass', and 'Printing of Online Check-in'. The AVNET logo is overlaid on the image.

AVNET[®] EMBEDDED

**The Embedded Opportunity Around
Human-Machine Interfaces**

The Embedded Opportunity Around Human-Machine Interface

A Human-Machine Interface, or HMI, is defined as the user interface that connects a person to a machine, system or device. Although that may seem simplistic, modern HMIs are everywhere and help users access useful information in a simple to use and understandable format.

As HMIs proliferate and become ever more complex, this guide aims to identify how and where the opportunity lies for manufacturers of embedded technology.

Although HMI is the most commonly used term, a number of other abbreviations can also be used, such as Operator Interface Terminal (OIT), Local Operator Interface (LOI) or Man-Machine Interface (MMI). HMI and Graphical User Interface (GUI) are terms which are sometimes used interchangeably, but which have different meanings. GUIs are often leveraged within HMIs for visualization capabilities.



What's New in HMI?

As businesses change and develop, the need for information has led to an explosion in the amount of data being generated, captured and stored. With hardware and software developments, sophisticated HMIs are becoming more common as the demands placed on them are diverse and varied. Better displays, richer graphics, and a range of different devices such as touch screen and mobile means there is more opportunity for innovation in HMIs than ever before. For example:

High Performance HMIs – have been developed to ensure fast and accurate communication of essential data. Simple and clean, these systems are built to optimise the user experience and show only limited or necessary data, at speed, allowing users to interpret and respond quickly.

Touch screens and mobile devices – instead of buttons and switches, the rise of smartphones has led to a demand for a more typical consumer-type interface, familiar to all. Mobile devices used at network edges and in industrial and SCADA type applications allow operators to simply tap the screen to access controls. This can be especially useful in more remote applications or across networks.

Remote monitoring and Edge computing – allow a number of benefits, the most obvious being the need to access data without visiting a physical location. As computing extends away from the datacentre, remote monitoring becomes more important. Edge devices allow operators to access data and visualization from the field and through the cloud alike.

Augmented Reality and Virtual Reality – as software continues to become more sophisticated, with greater capabilities to manage and augment data with machine learning and artificial intelligence, AR and VR become useful tools in data modelling and display. HMIs become more important in being able to access and show this data and in themselves will continue to develop in sophistication as the access point into the network.

IN THIS REPORT WE WILL FOCUS ON 3 KEY AREAS OF HMI:

- Display and the development of touch,
- Graphical User Interface (GUI)
- How HMIs can be used specifically in manufacturing.



Expertise In HMI Solutions at Your Fingertips

Avnet Embedded specializes in combining compute, display and software technology into full-scale human-machine interface (HMI) solutions for a wide range of industries. From industrial farming equipment to household kitchen appliances, we design, manufacture, and deliver HMI solutions to OEMs so they can focus their resources on their own innovation.

Whether you need just one part of an HMI solution, or the whole solution from screen to cloud, Avnet Embedded can build your solution for you and get your product to market faster, better, and stronger.

Avnet Embedded's in-house design and manufacturing expertise, combined with our global partner and logistics network, means we can deliver a comprehensive HMI solution to OEMs, customized to their own needs. We assemble HMI solutions in our own campuses all over the world so we can integrate flawlessly with our customers' manufacturing requirements.

OUR CAPABILITIES INCLUDE:

- Displays and Touch screen interfaces
- Software advice, licensing and support
- Compute capabilities and integration

We can also advise on all aspects of the software you require as part of your HMI solution, including assisting you with the correct advice on release, licensing, security, and longevity.



FASTER

We reduce your development time and get your product to market faster than the competition.

Our rapid development platforms like SimplePlus and SimpleFlex can help you develop compute and display solutions in less than half the time it would normally take.



BETTER

We make sure you're taking advantage of the latest technological advances, making your product better.

Close relationships with chip and display manufacturers, and software companies, ensure you're ahead of the curve on exciting new possibilities. A broad network of off-the-shelf hardware partners means you'll always get the right solution for your scale and budget requirements.



STRONGER

Our expertise reduces your costs and risks, and our global supply chain improves your efficiency, making your business model stronger.

We have over 100 years of experience in building technology for our customers, and Avnet has one of the world's best distribution networks.

The Perfect Partner for HMI

Avnet Embedded's technical specialists work with OEMs through the full cycle of product design from initial prototyping through to aftermarket service and support, for all aspects of embedded devices and systems, including HMI.

OUR SERVICES INCLUDE:

- Initial design
- Prototyping
- Production engineering
- Custom compute manufacturing
- Display bonding
- Touch integration
- Full system assembly
- Chassis assembly
- Software installation
- Testing and evaluation
- Endurance and stress testing
- Burn-in
- Product integration

LEADING HMI INNOVATION ACROSS MANY INDUSTRIES:

We work with many of the most recognized brands in industries that demand innovation, reliability, durability, safety and consistency. Some key markets we serve include:

- Healthcare / medical devices
- Self-service food & retail kiosks
- Industrial machinery
- Scientific equipment
- Aerospace
- Luxury consumer electronics
- Smart building controls
- Public transportation
- Robotics

Solving The Challenges of Touch and GUI

Touch displays are becoming ever more present in HMI solutions and HMI devices can be found throughout the organisation's network.

This means that there can often be a wide range of environmental challenges or different requirements relating to usage throughout the network or project and Avnet Embedded's touch team is regularly called upon by OEMs to solve for specific situations.

THESE CHALLENGES MIGHT INCLUDE:

- Electrical interference
- Extreme heat or cold
- Sensitive environments
- Usage with gloves
- Liquid and dust resistance
- Tamper-proofing
- Air gap bonding



In addition to solving these challenges, Avnet Embedded also provides certifications of compliance with various industry standards to ensure compatibility and functionality.



Graphical User Interface (GUI) Design

Because Avnet Embedded brings together expertise in embedded computing, displays and software to be the perfect partner for design of human machine interfaces (HMI). A big piece of the HMI puzzle is graphical user interface design, and Avnet Embedded can help here, too.

Graphical user interface depends on all three elements of HMI design – compute, display and software. Our innovation team understands all these elements and has years of experience in what makes good user interface. We can develop a GUI in tandem with the other factors that are important in your project, to optimize the interactive user experience.

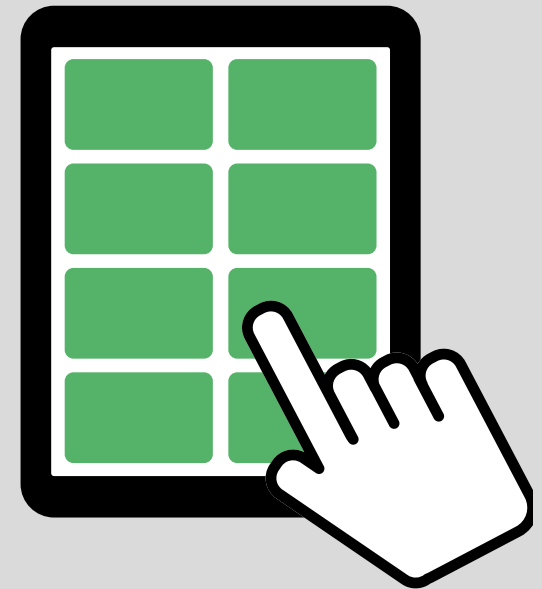
We work with Microsoft Windows 10 IoT to help us develop your GUI with no limitations.

We offer GUI design as an add-on service to our HMI solution as well as a standalone service and our team can guide you on the most appropriate way forward.

YOUR PATH TO EXCEPTIONAL USER EXPERIENCE

Avnet Embedded's Graphical User Interface design services include:

- User experience design
- Basic UI skinning / branding
- Full UI design including buttons, menus, controls etc.
- Software-hardware interface mapping
- OS customization
- BSP development
- App design
- IoT connectivity design
- Dashboarding and reporting
- Operating system (OS) customization
- Software security hardening
- Internet-of-things (IoT) integration
- Cloud connectivity
- Over-the-air (OTA) updates
- App design & integration



Embedded Software for HMI

Software is a key element of any HMI devices. It is the intelligence that drives the system, manages, and displays the data. As well as designing and manufacturing perfect hardware solutions, Avnet Embedded offers an unmatched capability when it comes to software. We were Microsoft's first industrial OEM (Original Equipment Manufacturer) partner, and we are still their biggest OEM partner and authorised IOT distributor globally.



We are a Microsoft Cloud Service Provider (CSP) and we have our own Microsoft Windows 10 IoT and Azure offerings, available exclusively through Avnet. Our software team link up with other areas of the business so for your HMI project you'll have experts to help with every step.

WHY AVNET FOR EMBEDDED SOFTWARE?

- We can help you translate your HMI product ideas into safe, secure, and scalable solutions and get you to market faster.
- Our expertise and experience mean we can support and advise you throughout the product development lifecycle on the most efficient and cost-effective solutions, saving you both time and money and shortening the development process.
- By handling the elements of hardware, software, licensing, and logistics, you can focus on your core businesses, knowing everything else is taken care of.
- Experts in operating systems, we can help with IoT, cloud, hybrid cloud, security, and virtualisation options.
- We offer a full range of complementary services such as software development, advice, loading and distribution.
- Our support on image verification helps you reduce your software footprint, increase security and control update instances.
- We provide dedicated training and support services when you need them. For example, our image workshop training shows you how to create a best practice image in 3-4 days. We also offer IoT workshops, and IoT and digitisation training.
- Our teams are local and responsive, but we still have a global reach to support you wherever you are.

HMI and Industrial Automation

Regardless of the format, which may range from built-in screens on machines, to computer monitors or remote tablets, the purpose of HMIs is to provide insight and intelligence into the functioning and performance of machines and systems. This makes the world of industrial automation an area of substantial opportunity for HMI.

With the increase in sophistication of industrial automation process and devices, and the growth in Edge computing, the importance of HMI in industrial applications is on the rise.

The roles that most commonly interact with HMIs are machine operators, systems integrators and engineers and HMIs are becoming ever more important to these users for their power in reviewing and monitoring production processes, diagnosing problems and visualizing data – useful both in the day to day and for reporting.

HMI AND SCADA

Typically, HMIs' communication is with Programmable Logic Controllers (PLCs) and input/output sensors to surface information for users to view. HMI screens can be restricted to a single function such as monitoring or tracking, or for performing more complicated tasks related to production such as altering speed or switching machines on or off.

Single consoles can now connect chains of processes by digitizing and centralizing data for a viewer to display important information in graphs, charts and dashboards. They can also work across different Manufacturing Execution Systems (MES) and Supervisory Control and Data Acquisition (SCADA) systems.



SCADA is a system of software and hardware elements frequently used in industrial automation settings which allows organizations to:

- Control industrial processes locally or at remote locations
- Monitor, gather and process real time data
- Directly interact with devices such as sensors, valves, pumps and motors
- Record events into a log file for scrutinization
- Access information through an HMI

SCADA systems help to maintain industrial efficiency, process data, help mitigate production issues and minimize downtime, and the use of ever more effective HMIs helps SCADA systems to do this in a more visually engaging way.

How Avnet Embedded Can Help With Your HMI Project

Unrivalled experience across compute, display and software technology means Avnet Embedded is the perfect partner for the design, manufacture, and distribution of embedded solutions all over the world. User experience is critical when designing new product offerings but identifying the right embedded, display and software technologies to power your projects can be complex, time consuming and expensive.

With a leading track record in delivering HMI devices that combine compute and display for a range of different organisations, Avnet Embedded is ideally positioned to help, whatever your requirements. Our team has the experience and capabilities to deliver technology solutions at any scale.

Our teams make it easy from the very beginning. Our design expertise will help you find the perfect technology for your HMI application, and we'll work with you to plan all elements of manufacturing, support, and product lifecycle planning. We can get your projects deployed faster, better and stronger.

Our partnership with other Avnet businesses means we can also provide comprehensive hardware support as well as interconnect, passive and electro-mechanical components, bringing the whole solution together. This helps to improve your user experience and provide limitless design possibilities. Importantly, we will cut your time-to-market and reduce your risk by leveraging proven designs.

THE BENEFITS OF AVNET EMBEDDED'S HMI SOLUTIONS:

- Reduce your time to market by taking you from idea to solution quickly
- Allow selection and configuration, with no extra development needed for standard products
- Integration of other Embedded, Wireless, Display and Software offerings
- Built-in versatility by utilising many customization options
- ARM and x86 scalability including AI acceleration capabilities
- Optimized designs for low production cost and simple customization
- EMEA wide support teams

With HMI solutions that balance cost with capability, Avnet Embedded can help you to identify the right embedded and display technologies for your needs, as well as working with you through manufacturing, support, and product lifecycle planning. This tailored approach to embedded and display technologies is fast, flexible, low-risk and proven to improve user experience.

How Avnet Embedded Can Help With Your HMI Project continued

WE CAN HELP IN 4 KEY AREAS:



DISPLAY

Avnet Embedded specializes in displays for every environment. With a proven track record designing and supplying displays for industrial solutions, healthcare devices, kiosks, ticket machines and vending machines, our display experts know what will work in every situation and temperature.

Display solutions perfect for HMI solutions include:

- Tamper-proof displays
- Weather-proof displays
- Passive displays
- OLED / TFT displays
- Rugged touch screens
- Industrial displays



COMPUTE

Avnet Embedded's industrial embedded computing platform is perfect for HMI devices. Building on success with self-service machines including vending, ticket machines and other customer-facing systems designed to operate flawlessly 24 hours per day and coupled with our extended lifespan support of up to 30 years, Avnet Embedded can meet all your compute needs for HMI.

Our Compute solutions include:

- Rugged compute design and manufacturing
- Security and tamper hardening
- Visual AI solutions information management
- Video processing and storage for security
- Wired and wireless connectivity
- Power management

We have partnered with Intel on compute solutions and can provide compute solutions in both x86 and ARM architectures. Our advanced embedded compute designs also provide capability for advanced functionality like recognition, tamper detection, biometrics and more, ensuring your HMI solutions will be world-class.

How Avnet Embedded Can Help With Your HMI Project continued

WE CAN HELP IN 4 KEY AREAS:

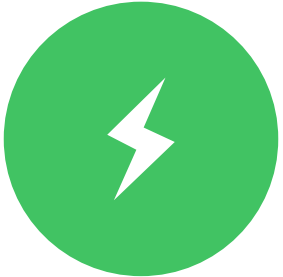


SOFTWARE

Avnet Embedded's Software design team manages everything from Operating System (OS) customization to Graphical User Interface (GUI) design and beyond. If you need the support of our in-house experts, we can provide it. We've designed customer interaction solutions for everything from coffee machines to aircraft.

Software solutions we can provide for HMI include:

- Payment systems
- User management
- GUI Design
- Functional reporting
- Remote management
- IoT connectivity
- Power consumption tracking and prediction



IP&E

Not only can Avnet Embedded handle the compute, displays and software, but by combining strengths with other teams in the Avnet stable, we can also provide comprehensive hardware support for interconnect, passive and electro-mechanical components, bringing the whole HMI solution together. All you need to do is tell us where to ship the finished unit!

Want to Find Out How to Get Your HMI Project to Market Faster?

Whether you're looking for a complete solution, elements of your build or just help bringing your design innovation to life, Avnet Embedded can fill in the blanks in your skillset and supply chain and get your HMI requirements deployed faster, better and stronger.

Let's talk!

Contact our team on avnetembedded@avnet.com to find out more and discuss how we can help make your HMI ideas a reality.

