

IoMT and AI Drive Medical Transformation

A combination of AI, big data and IoT has resulted in "smart hospitals" **P.08**



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Smart Healthcare
Command Centers:
Utilizing Data Integration
to Improve Quality and
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ADVANTECH



WISE-PaaS
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Smart Healthcare Command Centers: Utilizing Data Integration to Improve Quality and Efficiency



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Address
No.1, Alley 20, Lane 26, Rueiguang Road, Neihu
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Tel +886-2-2792-7818

Website www.advantech.com

Editorial Supervisor
Brand Development & Public Relations

Art Director
Jie Tang

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Editorial Lohas Technology Co.Ltd.

Director David Lai

Address 12F-1, No.169, Sec. 4, Zhongxiao E. Rd., Da'an
Dist., Taipei City 106, Taiwan (R.O.C.)

Tel +886-2-2732-8899

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Integrated OR
 Advantech AVAS Video Archiving and Streaming

Advantech Video Archiving and Streaming for Intelligent Operating Rooms

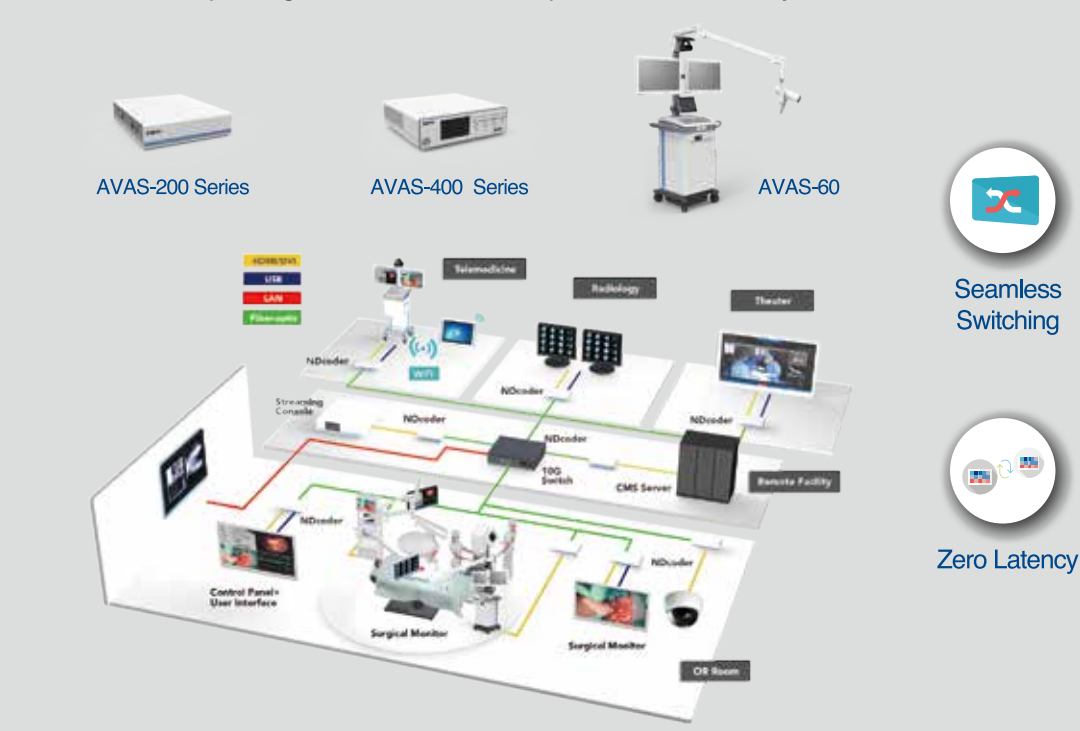
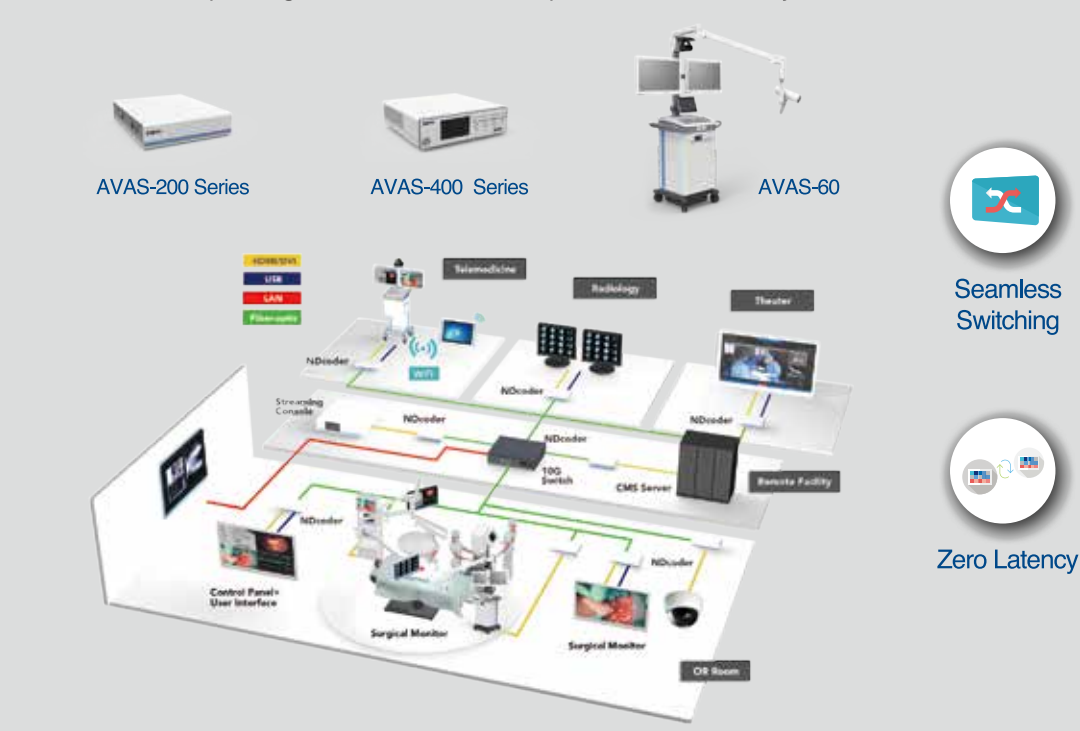
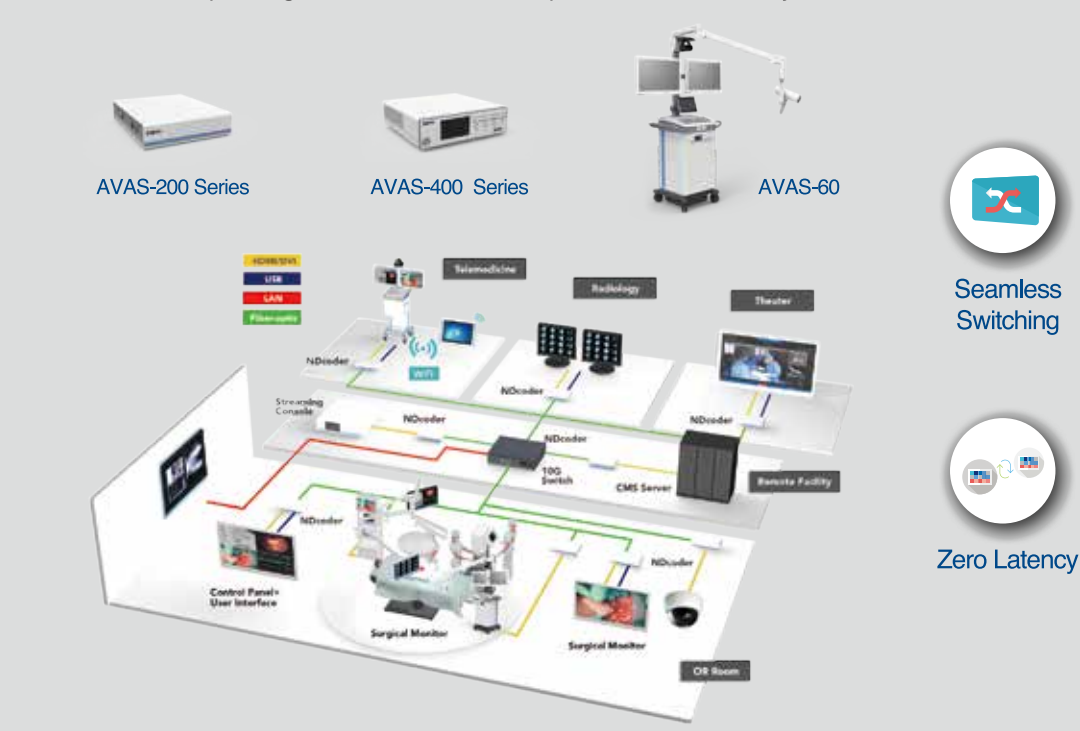
With the increased complexity of surgical procedures, several factors including the use of diverse image sources, lack of surgical technique storage systems, and external communication difficulties are reducing the efficiency of operating room workflows. Advantech's AVAS solutions support real-time image and video streaming, centralized control, remote teaching and consultation, and cloud-based management in order to streamline operating room workflows and improve overall efficiency.

The diagram illustrates the AVAS system architecture, showing three main series of equipment: AVAS-200 Series, AVAS-400 Series, and AVAS-60. Below these, a detailed network layout is shown, connecting various components in a surgical suite. The layout includes a legend for connection types: NDcode (yellow), USB (blue), LAN (red), and Fiberoptic (green). Key components and their connections include:

- Telemedicine:** Connected to the AVAS-400 Series via NDcode.
- Radiology:** Connected to the AVAS-400 Series via NDcode.
- Theater:** Connected to the AVAS-60 via NDcode.
- Streaming Console:** Connected to the AVAS-200 Series via NDcode.
- 10G Switch:** Acts as a central hub, connected to the AVAS-200, AVAS-400, and AVAS-60 via NDcode.
- CMS Server:** Connected to the 10G Switch via NDcode.
- Remote Facility:** Connected to the CMS Server via NDcode.
- Control Panels User Interface:** Connected to the AVAS-200 Series via NDcode.
- Surgical Monitor:** Connected to the AVAS-200 Series via NDcode.
- OR Room:** Connected to the AVAS-200 Series via NDcode.

On the right side of the diagram, two circular icons highlight key features:

- Seamless Switching:** Represented by a circular arrow icon.
- Zero Latency:** Represented by a circular icon with a clock and a signal wave.



AVAS-200 Series

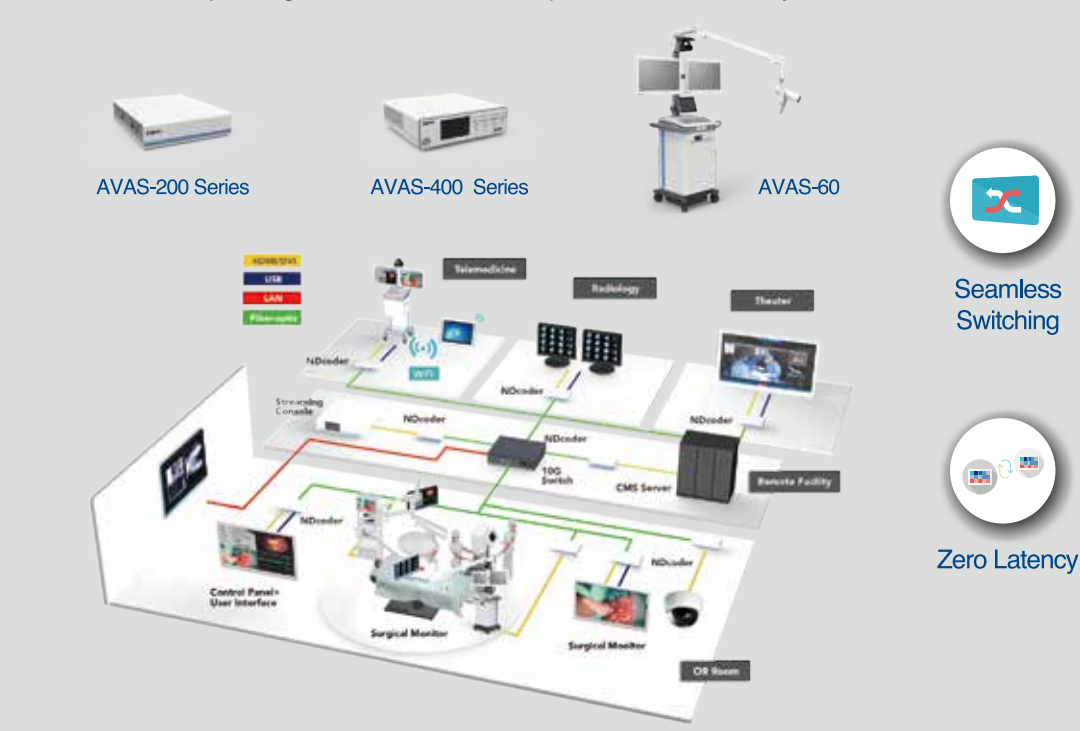
AVAS-400 Series

AVAS-60

Seamless Switching

Zero Latency

The diagram illustrates the AVAS system architecture, showing three main series of equipment: AVAS-200 Series, AVAS-400 Series, and AVAS-60. Below these, a detailed network layout is shown, connecting various components including NDdecoder, Streaming Console, 10G Switch, CMS Server, Remote Facility, Control Panels User Interface, Surgical Monitor, and OR Room. The layout is color-coded by connection type: NDcode (yellow), USB (blue), LAN (red), and Fiberoptic (green). The system is designed for Seamless Switching and Zero Latency.

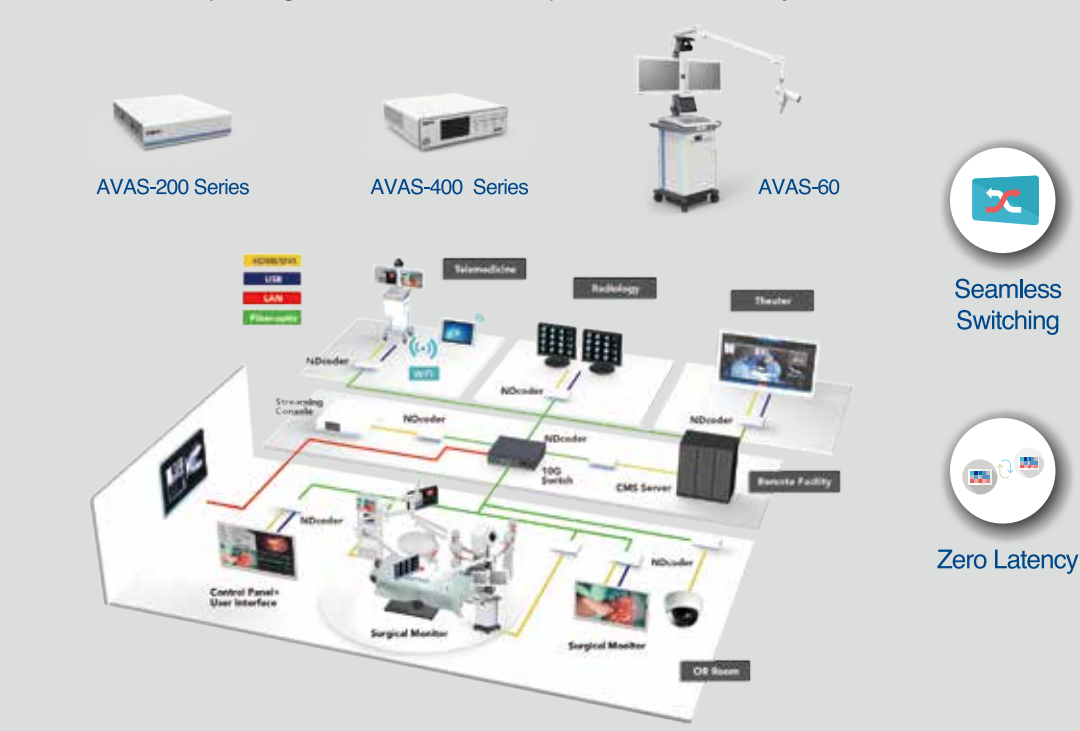


The diagram illustrates the AVAS system architecture, showing three main series of equipment: AVAS-200 Series, AVAS-400 Series, and AVAS-60. Below these, a detailed network layout is shown, connecting various components in a surgical suite. The layout includes a legend for connection types: NDcode (yellow), USB (blue), LAN (red), and Fiberoptic (green). Key components and their connections include:

- Telemedicine:** Connected to NDdecoder and NDcode.
- Radiology:** Connected to NDdecoder and NDcode.
- Theater:** Connected to NDdecoder and NDcode.
- Streaming Console:** Connected to NDdecoder and NDcode.
- 10G Switch:** Connected to NDdecoder and NDcode.
- CMS Server:** Connected to NDdecoder and NDcode.
- Remote Facility:** Connected to NDdecoder and NDcode.
- Control Panels User Interface:** Connected to NDdecoder and NDcode.
- Surgical Monitor:** Connected to NDdecoder and NDcode.
- OR Room:** Connected to NDdecoder and NDcode.

On the right side, two circular icons highlight key features:

- Seamless Switching:** Represented by a circular arrow icon.
- Zero Latency:** Represented by a circular icon with a lightning bolt.



The diagram illustrates the AVAS system architecture, showing three main series of equipment and a detailed layout of an operating room (OR) setup.

AVAS Series:

- AVAS-200 Series:** A compact, rack-mounted unit.
- AVAS-400 Series:** A larger, rack-mounted unit.
- AVAS-60:** A mobile unit on wheels, featuring a large monitor and a camera arm.

OR Setup Diagram:

The diagram shows a surgical suite with various components connected via NDcoders and a 10G Switch:

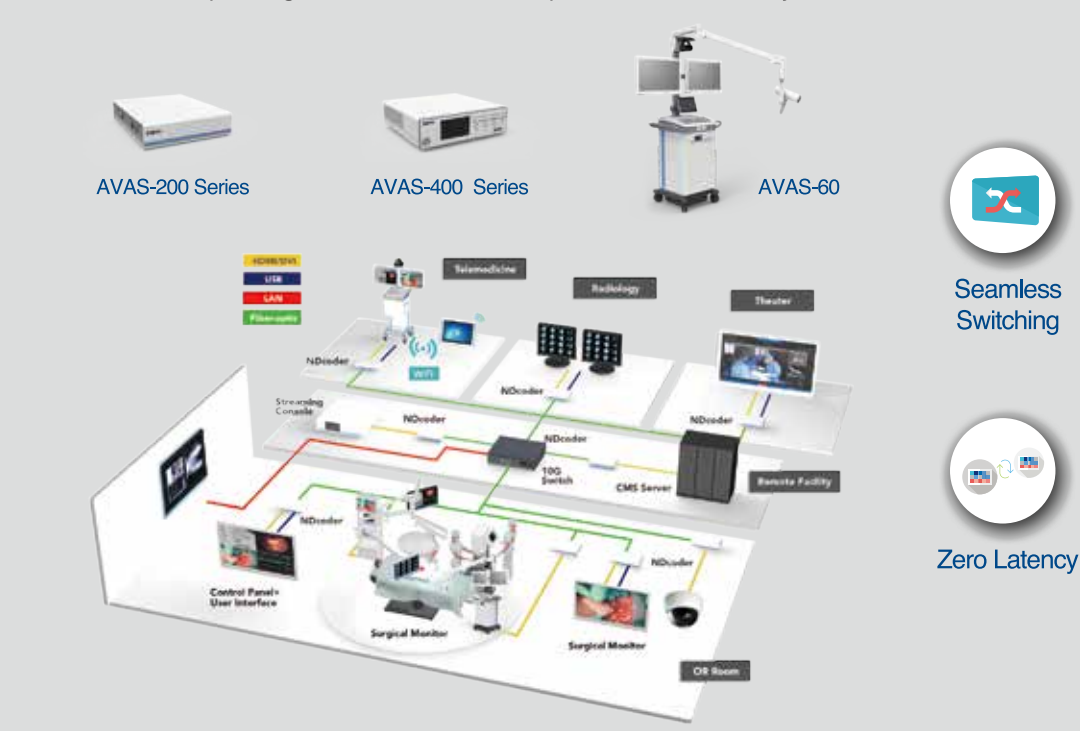
- Telemedicine:** Includes a Telepresence unit and a Streaming Console.
- Radiology:** Includes a Radiology unit and a Radiology Facility.
- Theater:** Includes a Theater unit.
- Control Panels User Interface:** A central control area.
- Surgical Monitor:** Multiple monitors for the surgical team.
- OR Room:** The overall operating room environment.

Legend:

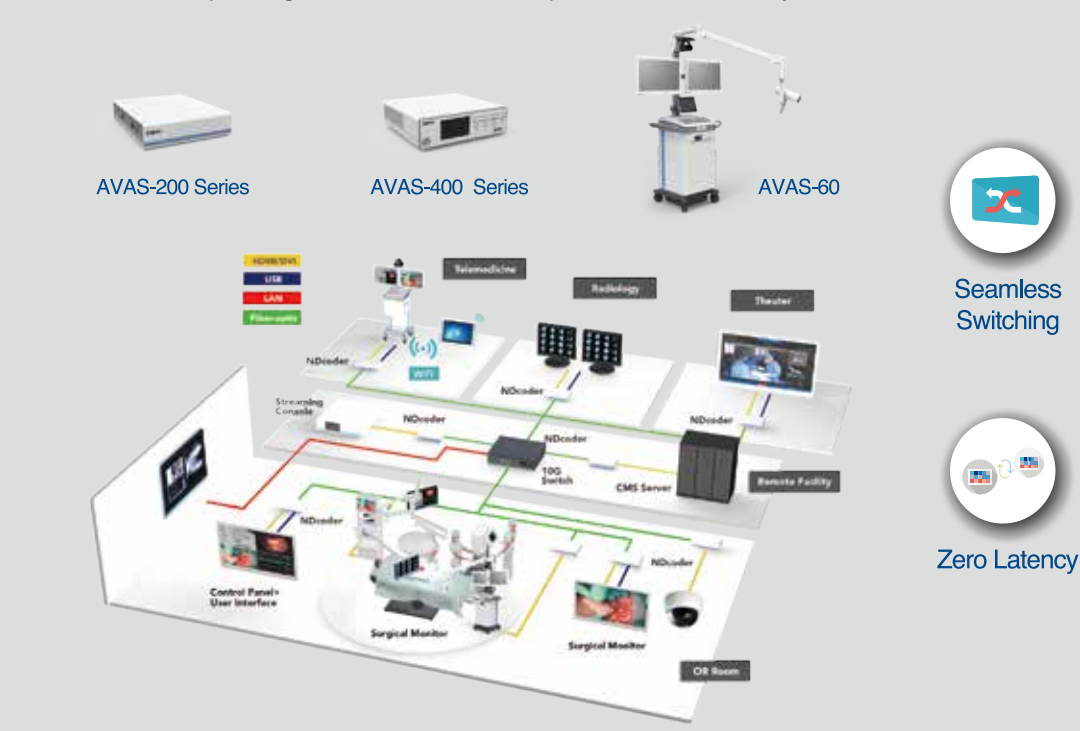
- NDcoders:** Represented by a yellow box.
- USB:** Represented by a blue box.
- LAN:** Represented by a red box.
- Fiber-optic:** Represented by a green box.

Seamless Switching: Indicated by a circular icon with a red and blue arrow.

Zero Latency: Indicated by a circular icon with a red and blue arrow.



The diagram illustrates the AVAS system architecture, showing three main series of equipment: AVAS-200 Series, AVAS-400 Series, and AVAS-60. Below these, a detailed network layout is shown, connecting various components including NDdecoder, 10G Switch, CMS Server, and multiple monitors (Surgical Monitor, Control Panels User Interface, Streaming Console, Radiology, Theater, Remote Facility). The layout also includes a legend for connection types: NDcode (yellow), USB (blue), LAN (red), and Fiberoptic (green). Two circular icons on the right highlight 'Seamless Switching' and 'Zero Latency' capabilities.

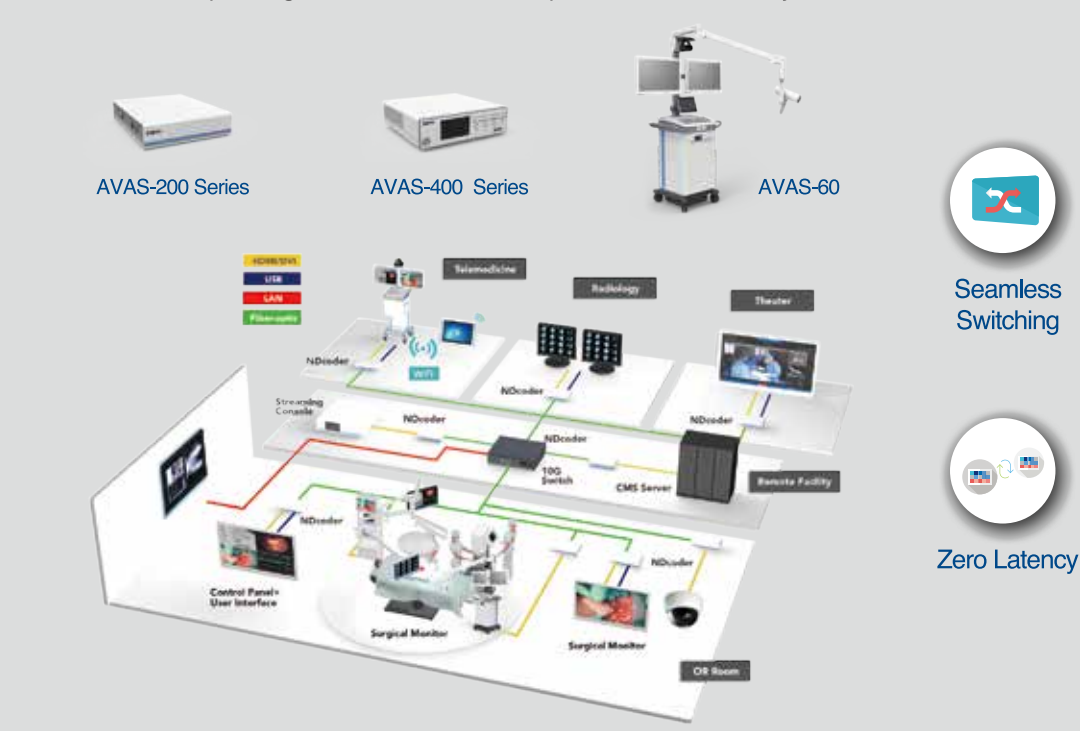


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- Telemedicine:** Connected to the AVAS-400 Series via NDcode.
- Radiology:** Connected to the AVAS-400 Series via NDcode.
- Theater:** Connected to the AVAS-60 via NDcode.
- Streaming Console:** Connected to the AVAS-200 Series via NDcode.
- 10G Switch:** Acts as a central hub, connected to the AVAS-200, AVAS-400, and AVAS-60 via NDcode.
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- OR Room:** Connected to the AVAS-200 Series via NDcode.

On the right side of the diagram, two circular icons highlight key features:

- Seamless Switching:** Represented by a circular arrow icon.
- Zero Latency:** Represented by a circular icon with a clock and a signal wave.



The diagram illustrates the AVAS system architecture, showing three main series of equipment: AVAS-200 Series, AVAS-400 Series, and AVAS-60. Below these, a detailed network layout is shown, connecting various components in a surgical suite. The layout includes a central 10G Switch, a CMS Server, and a Remote Facility. It also shows a Streaming Console, a Control Panels User Interface, and multiple Surgical Monitors. The system is connected via NDcode, USB, LAN, and Fiberoptic links. The diagram also features icons for 'Seamless Switching' and 'Zero Latency'.

AVAS-200 Series

AVAS-400 Series

AVAS-60

Seamless Switching

Zero Latency

AVAS-200 Series

AVAS-400 Series

AVAS-60

Seamless Switching

Zero Latency

From Digital Medical Care to Smart Medical Care

Due to the rapid rise of Artificial Intelligent (AI) and the Internet of Medical Things (IoMT), a new revolution is revitalizing the medical industry. Scientists and companies have been investing in intelligent medical applications, from gene editing and sensing chips to intelligent wards and remote smart medical care, aiming to detect the changes in all kinds of human illnesses and conditions. For example, 467 innovation teams from 25 countries around the world participated in the Innovation and Startup Zone (InnoVEX) of COMPUTEX TAIPEI 2019 in late May of this year, amounting to a growth rate of more than 40% when compared to the previous year, making it a record-high exhibition scale. It is worth mentioning that “smart medical care”, which combines the momentums of technology and the medical industry, was one of their major priorities.

Driven by AI and the Internet of Things (IoT), this revolution in the medical industry is progressing far faster than initially anticipated. According to a report published by Deloitte, the global medical care expenditure will reach 8.7 trillion US dollars by 2020, while the output value of IoMT applications will reach 158.1 billion US dollars in 2022. It is estimated that the output value of medical materials in Taiwan will reach 200 billion new Taiwan dollars next year, with the main growth momentum coming from the aging population, the increase of chronic diseases, and the growth of medical demand. To ensure the quality of medical services and control costs effectively, it has become a common goal of the global medical industry to go digital and intelligent, thus driving the birth of a new smart medical supply chain.

Smart medical care covers a wide range, while most of the current smart medical applications focus on medical treatment itself. According to the

World Health Organization, smart medical care is defined as the applications of communication technology to the medical industry, encompassing medical care, disease management, public health testing, education and research. Therefore, not only should the smart medical care focus on the digitalization of paper materials, but also, it should try to create a consumer-centered healthy ecosystem through IoMT, in combination with new technologies such as big data analysis and artificial intelligence. Moreover, as innovative technologies have been gradually applied to the field of medical care, future medical practice will not only be turned into a patient-centered model, but also shift its focus from the disease treatment model to holistic healthcare, disease prevention and early treatment.

Science, technology and medical treatment can be regarded as two of the most powerful industries in Taiwan. How should Taiwan, with its complete electronic manufacturing supply chain, build a strong smart medical industry through the cooperation of these two most powerful industries? How should Taiwan grasp the amazing business opportunities and link up an even larger industrial eco-chain to create opportunities for the export of smart medical products? This issue of My WISE-PaaS is based on the theme of “IoMT and Artificial Intelligence: Two Major Engines Driving Medical Transformation,” under which we have invited experts in the field to share their observations on the trends of smart medical care. We also hope that these success stories and cases in which Advantech has helped major hospitals create a variety of smart medical services can stimulate innovative thinking and inspire our strategic partners to create opportunities and be leaders of progress. ■

An-Jie Ren, Assistant to President of HIMSS Greater China and Director of Training Center

“Three Wholes” Vision for Patient-centric Medical Information

By Pei-jun Liao with images provided by Advantech

The medical industry has been riddled with invisible walls for a long time. Every hospital itself is a wall and so is every department within the hospital. The patient’s medical information is independently and separately kept within the invisible walls by the hospital or the department where he or she sees the doctor. Most medical information is difficult to access, process and share as if nobody can penetrate the invisible high walls. This inaccessibility forces patients to repeat seeing doctors in different medical institutions, causing a significant waste of medical resources as well as being largely inconvenient for the patients. Therefore, the concept of “Three Wholes: whole person, whole process, whole cycle” has been raised in a hope to improve the quality of medical services.

Whole person, whole process, whole cycle: The Patient-centric Information Concatenation

The concept of “whole person” refers to connecting all of the medical and health information of one individual patient in order to provide him or her with exclusive, personal and continuous medical care.

Meanwhile, the concept of “whole process” takes data integration and patient engagement even further, even if he or she receives medical services in different practices. This is a process that can link the treatment process across various healthcare providers to create a patient-centered platform that utilizes data and technology in which the patient can find peace of mind.

“Whole cycle” means that through the application of technology, the medical care system can clearly grasp and completely obtain the medical and health

information of an individual patient from his or her entire life process, ranging from birth, growth, aging and even death. In other words, the “whole cycle” medical system can break the time and space constraints to get all of the patient’s medical history without being confined to the description of physical condition at the moment of his or her visit to the doctor.

At present, I have seen that many IT companies such as Advantech actively develop and integrate smart healthcare-related solutions, encouraging hospitals to build the infrastructure needed for smart healthcare. By reengineering their processes with smart healthcare as the core, they are able realize the concept of “Three Wholes” and even help improve the gradually rising labor costs, reduce negligence, and comprehensively improve medical quality.

System integration process reduces error rate and ensures patient safety

Many people may wonder why technological applications impact medical quality so highly. I may make it clear to you by citing an example from patient ward medication management, which includes medicine purchase, arrival, shelf, storage, and dispensing. Before the medicine is dispensed to the nursing station, two procedures must be carried out, that is, the doctor must first write out the prescription and the pharmacist must review it. Then, the nurse can give the patient the prescribed doses regularly at the bedside and records/observes the patient’s physical conditions, so that the doctor can determine the efficacy of the medication.

Because the pharmacy management procedures are trivial, interlocking and highly related to the



By reengineering their processes with smart healthcare as the core, they are able realize the concept of “Three Wholes” and even help improve the gradually rising labor costs, reduce negligence, and comprehensively improve medical quality.

safety of patients, the hospital will usually establish a Closed Loop Medication Administration (CLMA) system, under which there are many detailed closed-loop medication specifications and workflows to ensure patient safety.

These management systems were ineffective during the traditional manual dispensing era. At that time, the hospital could not know whether the staff had followed the relevant procedures to administer medication or which part of a case had gone wrong. Therefore, pharmacy management was always regarded as one of the medication procedures with the highest error rate. Now, via information systems, we can automatically check whether each procedure is correct or not and even identify problematic cases to be double checked manually. The rest of the medication can be checked under the “whole process” CLMA system, so as to improve the efficiency of overall care.

EMRAM model to effectively evaluate the degree of hospital electronicization

Using the Xiamen University Hospital as a case study, it can be seen that a well-designed system can easily perform “whole process” Closed Loop Medication Administration (CLMA) to improve the accuracy and safety of medication, instead of manual inspection. The Advantech Smart Medication Management System solution is a system that meets the Level 6 or higher requirements of the EMRAM (Analytics Electronic Medical Record Adoption Model) and uses RFID technology paired with individual medicine box locking mechanisms to accurately track the administration process from the

pharmacy to the nursing station to the hospital beds. This will ensure that all the medicine boxes during the intermediate process are correctly replaced and moved, so as to reduce the error rate and ensure patient safety.

The EMRAM model that I have just mentioned is actually designed by the Health Information and Management System Society (HIMSS), where I am working. The main application of the EMRAM model is to evaluate the application level of hospital electronic medical records.

At present, this model has a total of eight levels from 0 to 7, of which the first six levels (0 to 5) focus on the establishment of medical information system software and hardware devices, through the system to manage or perform clinical work, while levels 6 and 7 require the hospital to have the ability to integrate data and analyze statistical data. From the level of hospital compliance, we can know the current electronicization degree of the hospital. The higher the level, the higher the degree of informationization of the hospital and the better the performance in ensuring patient safety and improving medical quality and efficiency.

In the future, I hope that IT companies interested in developing intelligent medical solutions can use their expertise in the Internet of Things to deepen the integration within medical management systems and urge medical institutions to reengineer their organization and process from information-driven ends and further promote their development of scientific research, artificial intelligence, intelligent medical care, etc. ■

Internet of Medical Things (IoMT) and AI Drive Medical Transformation

As information technology continues to evolve, today's medical industry is not only digitalizing paper materials, but also introducing Internet of Medical Things (IoMT) and artificial intelligence technology to create a patient-centered smart hospital.

By Pei-jun Liao with images provided by Shutterstock

Achieving adequate manpower has been a global challenge for the medical industry. Compounded by the social development trend of aging population with fewer children, medical care manpower will decrease, even though there is an increase in the care for the elderly population.

According to the Deloitte survey report, global health care spending is expected to grow at a rate of 5.4% per year from 2018 to 2022. Compared with 2.9% in 2013-2017, the growth rate has accelerated significantly due to such factors as the rising proportion of elderly population and the ever-increasing number of chronically ill patients. To ensure the quality of medical services and to effectively control costs, it has become the common goal of the global medical industry to move towards digitalization and intelligence.

Of course, the digitalization of the medical industry isn't a new concept. It has been advocated for many years now, with applications such as electronic medical records, hospital information systems (HIS), nursing information systems (NIS), and picture archiving and communication systems

(PACS). However, with the continuous evolution of information technology, today's medical industry is not only digitalizing paper materials, but also introducing Internet of Medical Things (IoMT) and Artificial Intelligence (AI) technologies to create patient-centered smart hospitals.

IoMT becomes a trend to embrace and open up integrated data

The Internet of Medical Things (IoMT) means the entire system begins with the acquisition and transmission of data from the underlying medical devices and equipment and then connects the patients, medical staff, and medical supply through the integrated application of information. This allows the hospitals to intelligently manage all the goods and equipment in the hospital and provide patients with intelligent medical services centered on them. In the "2019 Medical Care Industry Outlook" report, Deloitte pointed out that the Internet of Medical Things (IoMT) can instantly monitor the patient's physical conditions and improve the speed and accuracy of diagnosis and treatment.

In the past, most medical devices and equipment

has limited capabilities. Information could only be stored in certain devices and equipment, and interconnection with other systems was very difficult. If medical care personnel wanted to know a patient's condition, they could only view the data on the equipment site, copy it by hand onto paper and then type it into the system. This kind of practice was not only inconvenient and vulnerable to human error, it also made it difficult to clearly understand the changes in the patient's physical condition. If the information in the medical devices and equipment can be collected immediately and the system is installed with an early warning mechanism, the medical staff can be notified of any problem as soon as possible so as to reduce the medical care risks during the process.

It is true that most medical devices and equipment used in hospitals are still of a traditional closed architecture and data acquisition devices must be used to obtain the information inside. However, the number of medical devices and equipment with network connection capability or data output function is increasing in the market year by year. When purchasing medical instruments, many hospitals have begun to include digital output devices in their procurement specifications. It is obvious that the opening up and integration of medical data are an inevitable trend and the biggest demand of hospitals.

However, in the aforementioned "2019 Medical Care Industry Outlook" report, the Deloitte also reminded the medical industry to pay attention to the security risks accompanying the IoMT. Networking itself is a risk because hackers may have the chance to invade the medical devices and equipment through the Internet. As medical devices and equipment are critical to the safety of patients and any kind of attack can cause huge losses, the medical industry must be very careful in this respect.

Large number of patient data and images are accumulated to develop the best foundation for AI applications

Aside from the IoMT, Artificial Intelligence (AI) is the second key technology for Smart Hospitals. The medical industry has already been conducting data digitization. If the digitized data can be combined with artificial intelligence and machine learning

technologies, many new changes will be brought forth to the current medical treatment model.

At present, the application of AI in the medical industry can be roughly divided into the following four categories. First is Precision Medicine: The human genetic sequencing is carried out through AI, allowing doctors to prescribe medicines in accordance with the patient's DNA so as to improve the treatment effect, instead of the current practice of using similar medicines to treat each disease. Alternatively, doctors may use AI to analyze the genetic sequencing of those patients who are inclined to special types of diseases. Second is Prediction Illness: AI can be used to analyze medical images and preliminarily screen out those patients who may be ill for further diagnoses and confirmation by the doctors. As medical examination instruments have become more progressive, medical imaging results have also become more sophisticated. For example, a computed tomographic image may contain more than 500 layers of scanned images, and AI applications can help doctors sift through the data to effectively and efficiently diagnose a patient. Third category is Labor Shortage of Medical Staff: AI can be used in telemedicine or consultation and regularly remind the patients with chronic diseases to take medicine. And lastly, the fourth category is Monitoring & Management of Personal Health: Wearable AI devices can be used to monitor changes in a person's heartbeat or blood pressure.

At present, the National Taiwan University Hospital has applied AI judgment to determine whether a patient suffers from tuberculosis, a process that takes less than 20 seconds. Taipei Veterans General Hospital has also introduced AI technology to automatically detect brain MRI images, which, when combined with more than 30 years of clinical experience from specialists, can be used to determine if a patient suffers from metastatic brain tumors.

As innovative technologies have been gradually applied to the field of medical care, its future will not only be turned into a patient-centered model, but its focus will shift from disease treatment to prevention and early treatment. It is hoped that while we are facing the aging society with limited manpower, we can still maintain a level of high-quality medical care services. ■

Saudi Arabia Transform Their Hospitals to Modernize Patient Medical Experience

The largest private medical group in Saudi Arabia has been actively transforming and modernizing itself in recent years. It has introduced the Advantech HIT bedside terminal devices in each ward to connect doctors, nursing staff, hospitalized patients and their accompanying family members on the same communication platform in hopes to improve quality and efficiency of medical services and a better overall experience.

By Pei-jun Liao with images provided by Advantech
Interview with Muiayed Kuo, Advantech's intelligent medical business manager

When it comes to hospitals, the first impression of most patients is that it is very dreary, confined, and the food is often less than stellar. However, Ken Ahmed has had a completely different experience. In his recent hospital visit, Ken was surprised to find out on the first day that there was a mobile touch screen on the side of the bed. When he wanted to know the details of the operation and/or the guidelines for a hospital stay, he simply interacted with the screen. When he felt bored, he could simply turn on the screen to choose a TV or movie program to watch. When he wanted to contact a nurse on duty, he could click on the button on the screen to begin communications, thus reducing a lot of his tension and anxiety during hospitalization.

Muiayed Kuo, Advantech's intelligent medical business manager, pointed out that unlike other medical institutes that have made introductions on a small-scale, experimental nature, this hospital decided from the very beginning to introduce the Advantech HIT bedside terminal device to each and every single ward, showing its strong determination to modernize its medical services. Currently, the Advantech HIT bedside terminal devices have been or are being introduced into the 4 hospital districts among the 9 hospital chains of the medical group.

As Advantech has designed systems in both Europe and the United States, it can give out quite a few reference cases that encompass complete solutions down to small peripherals and brackets which not only meets the medical standard EN60601 certification but

can be customized to satisfy all the needs of the user. Everything from the adjustment in the bracket (or arm) design to the print of a hospital name on the screen logo can be built accordingly by the client's request, making Advantech solutions an easy option.

Integrate HIS system to improve medical efficiency

Through the Advantech HIT bedside terminal devices, the medical group has solved many of the medical care problems often encountered in the past. For instance, in the past, the doctor would take a tablet computer to the ward to explain the surgical procedure and remind the pre- and post-operative precautions. Sometimes, the doctor would even explain orally without a tablet, but it was not easy for the patient and his or her accompanying family members to understand the doctor's explanation and to read the detailed information on the mobile screen. Now, the doctors can directly explain everything on the larger screen through the bedside terminal devices and the integrated medical information system. The patients can now understand and visibly follow along clearly in the first engagement.

In addition, the Advantech HIT bedside terminal devices can also provide more information about hospitalization. The hospital environment/map, directory and educational resources can now be viewed at the patient's own convenience. The patient has more freedom of comfort by operating these devices which are now at his or her bed and to choose the information or media he or she chooses to watch during their stay.



Muiayed Kuo said that in the past, such information had to be explained verbally by the nursing staff or printed out and sorted into a thick folder and placed in the ward for patients to consult. However, no matter whether the information was presented in a spoken or written way, the film presentation was always the best option. In addition, video can relieve the patients from the worry of not being able to remember the contents, because they can always go back to open the bedside terminal device and watch the video again at any time.

Virtualization of the nurse bell makes it possible for the patients to click and talk to the nurse to solve his or her problems

The HIT bedside terminal device also has a built-in call function, which can be synchronized with the nursing station. In the past, only one Nurse Call button was set up in the ward and might cause some troubles to the patients. For example, after the patient completed a drip injection and needed someone to help turn his or her body over or go to the restroom, he or she could only press the bell to call the nurse but could not explain right away what the needs were. The patient could do nothing but wait until the nursing staff arrived at the ward. To make things worse, the nursing staff might not necessarily come over immediately. If the patient waited for too long, he or she would inevitably become anxious.

Now, through the HIT bedside terminal devices, the patient can call the nursing staff and directly say and explain what assistance he or she needs, so that the

nursing staff can prepare in advance. It is obvious that the devices not only improve the efficiency of the nursing staff, but also helps the patient to reduce his or her anxiety in waiting for the nurse.

Currently, the HIT bedside terminal devices provide not only medical care information but also networking and multimedia functions, enabling the patients to watch TV or movies, log on to social media sites such as Facebook and Instagram, and use Skype and other messaging applications and access customized services, such as: selection of a meal, so that the patients can have a better hospital experience.

Muiayed Kuo revealed that after the adoption of the Advantech solutions, the medical group has not only reduced the working time for nursing staff and improved the quality of medical services, but has also increased the source of revenue (that is, provision of various paid services through the bedside terminal devices). In the future, the medical group will not only expand the application scope to the remaining five hospitals, but also plans to introduce the WISE-PaaS platform's Command Center application and integrate on the same platform for analysis the information that can be seen through many sets of software. For example, patient waiting time, operating room usage rate, etc. It is hoped to create a virtual Command Center through the integration of HIS and WISE-PaaS platforms, so as to further improve hospital management efficiency and reduce costs. ■

Russian NRCERM Hospital Works with Advantech to Create New-Generation High-Tech Operating Rooms

In order to update all 14 operating rooms, the NRCERM Hospital in St. Petersburg, Russia, decided to adopt the Advantech POC fixed-point care system to automate the medical workstations and medical information. This improved the efficiency of operating rooms while continuing to provide patients with high quality medical care.

**By Pei-jun Liao with images provided by Advantech
Interview with Russian NRCERM Hospital**

In the operating room, the doctor is focused on the patient's surgery, while several assistant physicians and nurses are on standby. Some will be assisting with the use of surgical equipment, some may even help by wiping the sweat off the surgeon, and others will be passing the surgical instruments. Regardless of the tasks, all of them are around the bedside, focusing their efforts on the patient and surgeon.

There is a medical caregiver wearing a surgical gown, standing distant from the hospital bed, focused on the computer screen in front of him. With his eyes looking forward, there is a screen showing real-time images of the operation. There is another screen next to the main screen, which shows the patient's medical record and examination images, making it convenient for the surgeon to understand the overall condition of the patient.

NRCERM introduces medical grade computer using IT to upgrade the operating rooms

This operating room, combined with technological applications, is not a fictional plot in a movie or a story but a real thing in the Nikiforov Russian Center for Emergency and Radiation Medicine (NRCERM) located in St. Petersburg, Russia.

Founded in 1991, the NRCERM Hospital is part of the Ministry of Emergency Situations of the Russian Federation (EMERCOM) and is a leader in the medical care sector in St. Petersburg. It currently has 14 operating rooms and 560 beds and treats approximately 15,000 patients every year.

Since its inception, the NRCERM Hospital has decided to provide important medical and surgical services that sets high standards for patient care. The NRCERM Hospital not only introduces the most advanced medical equipment but also actively develops information technology, such as: the introduction of Hospital Information System (HIS), improving medical quality management and implementing electronic medical record applications; NRCERM Hospital successfully passed the EMRAM level 6 certification in 2017, where the EMRAM is an international medical health message and evaluation model designed by the Health Information and Management System Society (HIMSS) to examine the application level of electronic medical records.

The NRCERM Hospital decided to introduce two medical-grade computers to upgrade all of the 14 operating rooms to continue to provide high-quality care for patients.

Under the planning of the NRCERM Hospital, each of the two computers play a different role. One acts as an automated workstation, which monitors the anesthesia process carried out by the anesthesiologist and records the physiological changes of the patient during the operation. It also automatically records and calculates in real-time. Which includes recording the medical instruments, medicines, materials, supplies used during the operation and will also display a surgical consent form.

The other computer allows medical staff to instantly receive all patient records, not just the data in the



electronic medical record system, but also images taken by medical examinations such as X-rays, computed tomography, and MRI. Since both computers are used in the operating room, the NRCERM Hospital requires both computers pass medical safety standards, easy to clean and disinfect, to ensure sanitation of the operating room and the implementation of infection control.

Mobile medical carts make medical decisions faster and more efficient

The NRCERM Hospital took some time to find a solution even after a long periods of research and comparison. Under the recommendation of the Mobile Computer Systems, a partner of the Advantech, the NRCERM Hospital decided to cooperate with Advantech to develop a medical workstation solution suitable for the operating room- the Advantech AMiS-60 mobile cart, which can freely move around in the operating room. The Advantech AMiS-60 consists of the POC-W212 medical point-of-care system and the POC-W151 DICOM converter.

Advantech's POC medical point-of-care is UL60601-

1, IEC 60601-1 / 60601-2 and EN 60601-1 certified, it has a medical grade equipotential bonding design and a separate COM / LAN connection port, which reduces the risk of electric leakage and shock. It also fully meets the requirements of the NRCERM Hospital guidelines with safety certification and reliability regulations.

The POC Medical Point-of-care system features the IP54-grade dust and water resistance. This helps prevent water and dust from entering and has easy cleaning feature to maintain the highest standards of hygiene and infection control.

In order to reduce administrative tasks as part of operating room management, the Advantech design makes it easy to quickly install the medical workstation solution and integrate seamlessly with existing medical information systems, surgical planning systems and the patient electronic medical records. Allowing the staff of NRCERM Hospital to view the medical examination imaging results, the patient medical records and the related files through the POC -W212 terminal device.

The POC Medical Point-of-care system can also serve as a control interface for a variety of devices, due to the built-in ports at the POC terminal, which has rich and diverse connection functions that can integrate peripheral devices such as cameras, card readers, RFID / Wi-Fi / Bluetooth modules, allowing the NRCERM Hospital to expand the systems functionality to specific application requirements. The POC terminal is also equipped with Intel® Active Management Technology (AMT), which enables the hospital to remotely control its equipment and devices to reduce maintenance costs.

Today's healthcare industry needs more mobility. If hospitals can access medical-related data, services, applications at anytime and anywhere, it can deliver medical services seamlessly and efficiently. Which holds great value to clinicians and patients. We are pleased that the medical workstation solution developed by the NRCERM Hospital and Advantech have met those needs.

This solution integrates existing information systems and other medical devices. With the combined cart design, it allows NRCERM medical staff to push the computer around freely, while remotely retrieving the patient's medical records, X-ray films and pathology reports at any period of time. Making decisions faster, effective and offer patients high quality medical services in an efficient manner. ■



Advantech Co-Creation Builds Intelligent Operating Rooms at the Erasmus Hospital in the Netherlands

Taking advantage of the construction of a new medical facility, the Erasmus Medical Center in the Netherlands, introduced the Medical Imaging Management and Transmission Solution co-created by Advantech and its partners – improving the efficiency of their operating rooms, quality of medical services as well as empowering their medical students and new doctors with high-end technology.

By Pei-Jun Liao with images provided by Advantech
Interview with the Erasmus Medical Center in the Netherlands

At 3 o'clock in the afternoon, the students of Erasmus University Medical School were gathered in the classroom with no lecturer at the podium. Alternatively, every student in the classroom was looking attentively at the front screen. The screen was showing a live surgical operation being carried out by the most experienced surgeon at the University.

The Erasmus University is a world-renowned public university located in Rotterdam. The Erasmus University Hospital is the largest and most prestigious hospital in the Netherlands. By means of the newly introduced Medical Image Management and Transmission Solution, the hospital can share real-time images in the operating room via streaming transmission to the other operating rooms

in the hospital. The image control center can also broadcast the streaming images to remote classrooms, allowing medical students to watch the surgery in real-time.

Advantech, INTER and SigmaXG work together to create an Operating-room Imaging Solution

The program originated in 2017, when the Erasmus Medical Center built a new medical facility with 26 new operating rooms. In the preparatory phase of the building, the Erasmus Medical Center decided to not only adopt modern and advanced medical equipment (following the example of large-scale general hospitals in other regions), but also actively reengineer its medical workflows and reduce the use of paper, posters or other

similar items through technological applications. The ultimate goal: enable the employees in the new building to work in a more comprehensive, digital, intelligent and highly integrated manner.

Of course, you can't just talk on paper about how to achieve this goal. You must introduce an innovative technology and application. To do this, you need to transmit ultra-high quality images from various surgical devices (such as endoscopes) to any surgical display screens and display them on those screens without delay or loss of image quality (Full HD; FHD) as well as to allow healthcare professionals to seamlessly switch between these different sources.

Although searching for a long time, the Erasmus Medical Center was unable to find a suitable solution with such a multi-faceted and complex system architecture. Finally, such a solution was successfully created under the cooperation of Advantech, Dutch medical system integrator INTER and Dutch network streaming equipment provider SigmaXG – A true and representative case of Advantech's co-creating solution model.

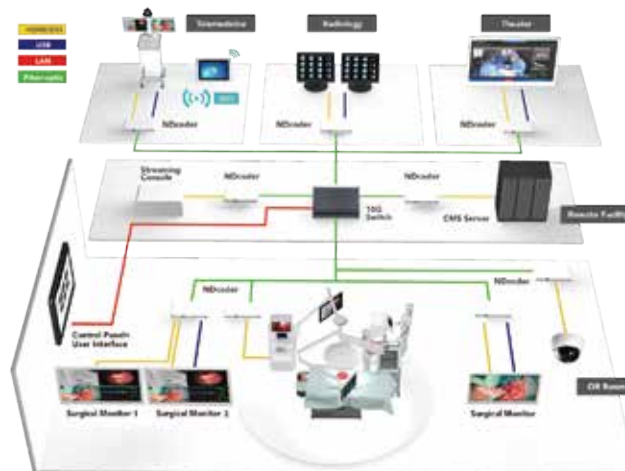
Advantech pointed out that through cooperation with professional partners, they can provide a one-stop solution covering software and hardware, not only to meet the needs of Erasmus Medical Center, but also to reduce the complexity of future system maintenance.

Now, through cross-industry cooperation, the medical industry can contact a single window, and greatly reduce the workload of system maintenance.

Advantech provides a full range of medical solutions from image server to display screen to all-in-one computer

In this co-creation solution, INTER provides the core control software for network streaming multimedia images. The hardware consists of Advantech's image Archiving and Streaming Servers (AVAS NDcoders), which are responsible for encoding and decoding images. SigmaXG's solution is applied to achieve 4K resolution. The SigmaXG device is directly integrated into the Advantech PAX medical display screen, an approach that not only saves energy and space but also reduces the complexity of the system, making this system easier to install.

Advantech's PAX medical display screen accurately and clearly display images from various sources. It can also show the patient's electronic medical records, medical examination images and other information, so that medical personnel can read relevant information



and simplify the work processes of the operating room – improving the efficiency and quality of medical services.

In addition to the image transmission devices, the Erasmus Medical Center has deployed Advantech's POC Series all-in-one medical computer, equipped with up-to-date medical grade certifications. This device can integrate multiple functions within the operating room further adding to improved efficiency. To ensure that surgery can be sterile and infection-free, the POC allows the staff to control the systems from inside or outside the operating room.

Moreover, the all-in-one medical computer can also be connected to different instruments according to the nature and needs of the operation, such as: neurology, obstetrics and gynecology. There are multiple modes to choose from, such as PACS system display, cloud electronic medical record, nursing record system, etc. It is convenient for doctors and medical staff to get all the information on a single screen, greatly shortening their time to move or query data during surgery.

In recent years, the medical industry has been affected by the following factors: increasing number of medical devices with networking functions, the need of continuous training for medical students or new doctors, improvement of administrative efficiency via image management, and so on. As a result, the operating room has an increasing demand for video and video communication. The Erasmus Medical Center has successfully introduced these operating room imaging solutions created by Advantech and partners, thus leading the future of intelligent operating rooms. ■

Note Taking Evolves at Evelina London Children's Hospital

Hospitals across the world have begun to understand the need for digital transformation, and those that embrace technology/IoT of healthcare will reap the benefits. According to studies, 86% of mistakes made in the healthcare industry are administrative.

By Pei-jun Liao with images provided by ECA Health
Interview with ECA Health

In our Co-Creation Summit in China, Dr. Peter RG Bak, CIO of Humber River Hospital, mentioned that 1 in 18 patients who are admitted to hospitals suffer from potentially preventable injuries. Hospitals today need to increase quality of care and drive down costs. Feeling unsafe in a hospital may seem ironic as that is where we seek professional healing, but the reality is that these newer hospitals embracing technology are becoming more reliable and safer for patients.

ECA Health, the dedicated medical division of ECA Services, is an OEM integrator and systems specialist with distinguished experience in digital healthcare and medical computing. Drawing from more than 100 years of combined experience in the sector, ECA provides a truly untapped resource that can help make digital transformations a reality. ECA positions themselves as a value-added solutions provider, building, customizing, and deploying precision engineered applications that can drive innovation, deliver first class care, and transform the lives of those in need.

Evelina London Children's Hospital

Evelina London Children's Healthcare is part of Guy's and St Thomas' NHS Foundation Trust and is the second largest provider of children's services in London. They provide comprehensive health services from before birth, throughout childhood and into adult life. Evelina London Children's Hospital's community services care for children and families in Lambeth and Southwark. Their children's hospital not only cares for local families but also provides an extensive range of specialist services for

children with rare and complex conditions from across south London, Kent, Surrey and Sussex.

ECA Health has worked with Guy's and St. Thomas' NHS Foundation Trust (client) over the last 10 years, and understands their unique requirements for medical-grade devices. After the Client decided they wanted to replace note taking at the bedside with a software alternative, ECA Health knew the solution to propose – a lightweight non-powered cart with Advantech's iPS-M100 hot-swappable power system and a POC-W213 system with integrated Wi-Fi.

Addressing the Problems

For the Client, there were many issues that must be addressed for all projects, and one of these was flexibility. While a fixed solution would require hardwiring, a mobile solution would require downtime for charging – both of which proved restrictive to Evelina Children's Hospital. Evelina is one of two specialist pediatric hospitals in London and has an environment for high-demand critical care. Overall, they needed a platform to be truly wireless; not just for power to run the hardware, but also connectivity to maintain operational readiness.

Another issue, like many hospitals face today, was sourcing a cost effective solution. Many clients understand that the overall costs of technology integration goes beyond just the implementation of products. There are multiple facets of implementation from the longevity/reliability aspects to services and maintenance that play roles in the overall decision. In this case, our replacement batteries in particular offered



a unique solution. The fact that we offer batteries with a 500 cycle capacity, was critical in the decision to choose Advantech, as knowing they will have consistent dependability over a specified period speaks volumes.

Flexibility, Performance and Wireless

In this hospital, and any hospital for that matter, it is important to select the correct solution with the required certifications. Evelina Children's Hospital knew Advantech offered rugged reliable solutions based on their historical use of the medical computers and support directly from ECA.

To fulfil the requirements and certification for Evelina Children's Hospital bedside note taking, three objectives needed to be achieved - flexibility, performance, and a completely wireless connection. As the unit was intended to support both bedside use and portability, ECA Health mounted the battery onto a lightweight, versatile, and medical-grade cart. The system could easily be maneuvered around without any disruption to on-board power and connectivity.

ECA Health then proposed Advantech's POC-W213, a widescreen Full HD Point-of-Care terminal equipped with Intel® i7 processors, flexible expansion capabilities, and wireless connectivity. Fanless, certified, and fully configurable, this platform delivered high-performance computing, fully connected and completely wireless, all within a certified and fully compliant footprint. The requirement of becoming completely wireless, was a bit of a challenge in the last phase. ECA Health had to focus on the power first. By incorporating Advantech's

iPS-M100 and its dual mounted hot-swappable Lithium-ion batteries, the workstation can remain wireless and fully powered with zero lag, interruption, or downtime for charging. The batteries are simply replaced and charged via a base station when required, resulting in a perfectly powerful, completely wireless, operational mobile unit.

The Mobility Era

ECA Health and Advantech's solution was designed for quick and seamless deployment upon delivery - no retrofitting, no hardwiring, seamlessly integrated, and fully supported. As a result, improvements in efficiency were seen shortly after deployment thanks to a stable and uninterrupted Wi-Fi connection. With an increase in digital real estate, this solution provided a more dynamic workplace for single and multi-task workflows including: charting, staff communications and ward monitoring. "As a fully mobile solution offering a consistent UX, system proficiency quickly improved, reducing downtime, increasing productivity, and allowing for a more consistent approach to care." Graeme Smith, ECA Sales Manager.

As more and more hospitals undergo complete digital transformations and reach a level of becoming "High Reliability Hospitals", the data will surely speak for itself. With the help of IoT and IoT enablers, we look forward to less errors, preventable injuries, and easy uninterrupted accessible data, that will ultimately shape the future of hospital care and save more lives. ■

Taipei Hospital, Ministry of Health and Welfare Embrace Data Visualization Infrastructure

Data visualization is crucial to hospital system architectures because hospitals have massive and complicated data to load every day. Taipei Hospital, Ministry of Health and Welfare improved data management effectiveness and data accuracy by integrating Advantech's Intelligent Medical Management Systems in the operation rooms and conference rooms.

By M.D Wang with images provided by Advantech
Interview with Li-feng Wang, Director of Information Office, Taipei Hospital, Ministry of Health and Welfare



The volume of data for hospitals is massive compared to other business agencies and governments. Due to this reason, the specification for the data requirements receiving and real time updating is very high. Taipei Hospital, Ministry of Health and Welfare implemented Advantech's Real Time Location System Solution (RTLS) with the electronic dashboards for nursing stations, operation preparation rooms, and operation rooms to improve the data management efficiency. In addition, it also implemented Advantech's LEO Electronic Paper Solution to Taipei Hospital, Ministry of Health and Welfare conference rooms to display the conference information.

Taipei Hospital, Ministry of Health and Welfare is one of twenty-six district hospitals that takes care of around 60,000 patients locally. Its eight operation rooms are constantly occupied from 7:00AM to 10:00PM for scheduled operations. Due to the complications of collected data, the importance of data management is a top priority to the hospitals.

Taipei Hospital, Ministry of Health and Welfare analyzes Comprehensive Operation Room Data by Receiving Patient Real-Time Data

Li-Feng Wang, Director of the Information Center of the Taipei Hospital, Ministry of Health and Welfare, pointed out that the medical staff in Taipei Hospital, Ministry of Health and Welfare used to record patient and operation information by manually writing on the dashboards. This manual process was prone to human error, and it was inconvenient to update the information. To improve the real time updating and data accuracy, Taipei Hospital, Ministry of Health and Welfare implemented RFID system to transfer patient data from ten years ago. The system can transfer patient

data wirelessly through electronic tags on patients' wristbands, which allowed the patient data to match with operation rooms.

The RFID system improved operation room data management; however, medical technologies progressed rapidly during the ten years. The RFID system has become outdated. In order to stay competitive, Taipei Hospital, Ministry of Health and Welfare evaluated the current systems and decided to implement Advantech's RTLS in the beginning of 2019. Advantech's RTLS has been applied to various medical scenarios with positive feedback. Through the connection between Hospital Information System (HIS) and Advantech's RTLS, it effectively improved the data accuracy of real time updates between operation rooms and nursing stations.

The operation room control system in Taipei Hospital, Ministry of Health and Welfare can be divided into two parts: patient status and operation room data collection. Patient status is continually updated by a built-in RTLS tag embedded in the patient wristbands, which is connected to a Beacon receiver to track the patient locations. The patient locations are then transferred to a back-end platform monitor and recorded. At the same time, the screen outside of the operation room will display the patient data to help patient's families track patient locations with a clear icon.

The monitors in operation rooms display all the operation data, including operation times, operation divisions, patients' names, the source of the patient (admission or emergency case), the categories of operations, the methods of surgeries, and the patients' conditions. This information is displayed clearly while the data operation rooms connects to the HIS system. It allows medical staff to keep track of the surgery status. Li-Feng Wang, a Director in the Information Office, pointed out that the real-time updates and data visualization reduced the data error rate and smoothed the hospital traffic flow.

Experts from Zhong Peng Intelligence and Advantech conducted many meetings with Taipei Hospital, Ministry of Health and Welfare medical staff and information room technicians to understand their requirements to insure Advantech's RTLS could run smoothly in Taipei Hospital, Ministry of Health and Welfare. Moreover, to help hospital staff transition to the new system, they began to use Advantech's RTLS while still using a traditional dashboard system before completely switching over to Advantech's RTLS.



Taipei Hospital, Ministry of Health and Welfare utilized better data management by improving the real time updates from operation rooms, operation schedules, patient status, and medical material management. Zhong Peng Intelligence and Advantech also provided complete system maintenance and fine tuning services to Taipei Hospital, Ministry of Health and Welfare to make sure the system continued to run smoothly month to month.

Advantech's LEO Electronic Paper Solution is Creative and Practical Because of Low Power Consumption and Wireless Data Transfer Features

Besides Advantech's RTLS, Taipei Hospital, Ministry of Health and Welfare also optimized data visualization by adopting Advantech's LEO Electronic Paper Solution to display conference room meeting information instead of a traditional paper signs. With Advantech's RTLS, meeting information is displayed digitally and can be controlled remotely. According to Li-Feng Wang, there were various display options in the market, Electronic Paper features low power consumption and does not require a connection to a power supply. This means that content can be displayed while avoiding the cost of power for a LCD display. Advantech's LEO Electronic Paper adopted Sub1ghz wireless communication technology, which works well at long distances even through thick walls. Moreover, Advantech's LEO Electronic Paper supports remote control by a back-end system, which tracks the locations of all Electronic Paper panels and give the ability to change the contents on each electronic paper remotely.

Advantech's LEO Electronic Paper can also be utilized for other purposes, such as mobile care cars, pharmacy medicine cabinets, and the HIS data synchronization. Advantech's LEO Electronic Paper helped pharmacists and the nurses compare data faster and corrected wrong data while dispensing medicine. Furthermore, Taipei Hospital, Ministry of Health and Welfare also plans to apply Advantech's LEO Electronic Paper to the hospital guest identification cards to simplify the hospital guest form procedure. ■



Yee Zen General Hospital Implements Command Center for Full Data Control

The information in medical institutions is massive and complicated; therefore, Yee Zen General Hospital adopts Advantech's Command Center Intelligent System to create the visualized information system with the concept of IoT, which greatly improves the efficiency of operation management.

By M.D Wang with images provided by Advantech

Interview with Geng-Wang Liaw M.D., Emergency Specialist Chief Secretary of Yee Zen General Hospital, Michael Lin, Director of Yee Zen General Hospital Information Department

Unlike most companies and organizations, hospitals generate large amounts of data which can be extremely complex. The medical teams from various departments, who deal with daily outpatients and hospitalized patients with all kinds of equipment in the Yee Zen General Hospital, are faced with challenging operations every day. Yee Zen General Hospital began to adopt Advantech's Command Center Intelligent System at the end of 2018 to integrate the original Hospital Information System (HIS) with the Internet of Things (IoT) to visualize the information in the hospital and improve management efficiency.

Scattered Information was Causing Problems in Yee Zen General Hospital Data Management

Yee Zen General Hospital was established in 1996 and is known as the "Hope of the Hill" because of the location in Yangmei. At that time, the number of employees was about 430, including 38 doctors. When the incumbent president Dian-Ying Li took the helm at the hospital, the number of employees grew rapidly and exceeded 550 people in 23 years, and the number of the medical staff reached 308 people. Nevertheless, Yee Zen General Hospital provides health care services in areas with over 600,000 residents, and that makes the cost for processing

the information generated by large number of medical personnel and patients very high.

Geng-Wang Liaw, M.D. the Chief of Secretary in Yee Zen General Hospital Dean's Office, points out that Yee Zen General Hospital implemented the HIS system to store various data to improve the hospital operational efficiency in early days. However, the data was hard to find once stored in the database because the source of data came from different divisions and was scattered throughout the clinic, emergency room, and hospitalization sectors. In addition, the data was classified by attributes such as medication, inspection, examination, imaging, etc., which made the data difficult to manage if the hospital didn't have employees with information processing experience.

Yee Zen General Hospital expects to build a visualized information management system to cope with the data management issue, which helps information managers grasp overall data and trends of hospital operational management quickly. In 2018, Geng-Wang Liaw was invited to participate in Advantech's Intelligent Medical Seminar where Advantech's Command Center Intelligent System was presented. At the moment, Liao knew that system was exactly what Yee Zen General Hospital needed.

Meeting the needs of Yee Zen General Hospital

Yee Zen General Hospital began efforts to adopt Advantech's Command Center Intelligent System in 2018. Geng-Wang Liaw and the IT team in Yee Zen General Hospital examined the issues they had and clarified what they truly needed by the steps below: The first step for building the system is to customize the user interface (UI) which contains the time interval axis, the graphics, and data charts. The second step is to set up flexible management functions to different divisions and job varieties, which follow the unified goal. The last step is to train IT team of Yee Zen General Hospital and to enable them to maintain the system by themselves.

With assistance from Advantech, Yee Zen General Hospital has confirmed the functions they wanted in the Command Center, and the system was launched in 2018 after several intensive discussions. Advantech's Intelligent Command Center System is divided into three parts: the center part is the core part of the whole system, which is a horizontal 84" LCD screen to display overall management Command Center in large number of charts and graphs. The left and the right side are carefully

placed 55" LCD screens: one screen rotates to display the real-time images from major areas, such as the halls, the pharmacy, the emergency rooms, and the rehabilitation centers; the other screen shows the comparative analysis of revenue data in the tabular format.

"Advantech has been deeply engaged in intelligent medical care for many years, and they are experienced in system architecture and capable of designing both software and hardware used in the medical industry. That's why the problems we faced during the system implement period could be solved quickly and the system could be launched in such a short timeframe," said Geng-Wang Liaw.

Extracting the data required by the Command Center without affecting the performance of HIS online was the other challenge Yee Zen General Hospital had. Usually, the IT team generates a checklist, which is then forwarded to the Command Center. As the Command Center reviews the checklist, they are able to receive data in real time from the LCD screens and ensure that HIS online is running smoothly. Advantech played a vital role in pulling all the stops for a perfect implementation for Yee Zen General Hospital.

Most of the original data required by the Command Center was collected and processed by the hospital's information department with some support from HIS computers. Advantech's technical team provided the data transferring between database (Postgres) and the HIS data (Oracle), as well as WISE-PaaS/Dashboard editing access. The data transferring by the Command Center system can be processed by WISE-PaaS and presented in the visualized format.

Within six months, Yee Zen General Hospital Command Center System was able to present the hospital's operation data, division comparison function, and trend analysis required by the hospital management team. In the future, the Command Center's message alert function, digital real-time images slides, and intelligent water and electricity monitoring functions will be integrated into the system.

Geng-Wang Liaw pointed out that modern-day trends to make operations intelligent has become the necessary structure for operations in medical institutions. Yee Zen General Hospital constantly adjusts the displaying of contents in the Command Center to closely match the system's functions and needs. In the future, Yee Zen General Hospital will continue to cooperate with Advantech to provide the best intelligent medical services to its patients. ■



Intelligent Ward System to Optimize Hospital Workflow



Balancing the efficiency of medical staff with patient safety is an issue of utmost concern. In order to improve the efficiency of medical practice and promote effective communication between doctors, nurses, and patients, the Chung Shan Medical University Hospital has adopted Advantech's Intelligent Ward (iWard) system.

**By Wei-zhen Ye with images provided by Advantech
Interview with Chiu-Hsiang Lee, Vice Superintendent of
Chung Shan Medical University Hospital
Department of Nursing**

“Intelligence is the current trend,” says Chiu-Hsiang Lee, vice superintendent of chung shan medical university hospital department of nursing. “Since 2016, the hospital has successfully upgraded to intelligent services for more than 400 beds so far.” The Advantech iWard solution for information integration improves the immediacy of use, helps medical care workers improve their work efficiency, and enables patients to receive better medical care through “humanized and intelligent” services when they are hospitalized.

Making traditional wards intelligent improves the efficiency of health education and management

The Chung Shan Medical University Hospital has spent over two years upgrading all the existing cots into intelligent wards. Unlike ordinary hospitals, which only upgrade the VIP or personal wards, the Chung Shan Medical University Hospital has introduced the bedside Patient Infotainment Terminal (PIT) system to all wards. PIT helps reduce the time the medical staff spends on training patients and family members and allows them to focus less on information delivery and more on treatment and care. The introduction of Advantech’s iWard System has undoubtedly provided great help in strengthening health education and improving management efficiency.

Chiu-Hsiang Lee pointed out that in the past, the hospital used to print out the healthcare pamphlets, give them to the patients and their family members, and assign a caregiver to provide relevant instructions on the health education. Once the caregiver was replaced, the health education information was also likely to get lost, so the nursing staff often needed to repeat the same service. With PIT, the hospital can directly input the health education information into the computer to display on the bedside, so that all the family members accompanying the patient can view it as well, not only consolidating the health education more thoroughly but also significantly reducing the time spent by caregivers in this respect.

The intelligent ward system also provides customized health education services. For example, patients with high blood pressure need to avoid and prevent falls. The nurses can use the bedside screen to directly explain to the family members on how to prevent the patient from falling and provide them with safety information. According to Chiu-Hsiang Lee, since the use of PIT and iWard, the “incidence of falls in the four units currently on the line has dropped from 0.14% to 0.10%.” This shows that the individualized bedside care system can



effectively improve the communication between medical staff and patients and their families.

In the past, it would take a long time for the explanation and consultancy on medication, which can now be displayed on the bedside screen through the medication information function of the PIT system, so that the patient can learn of his or her medication methods. This results in a great reduction of time for the nursing staff. Meanwhile, the PIT system can also display on the screen extraneous information such as conditions, history of allergies, things to avoid during treatment, etc., so that the medical team can better understand the patient’s specific situations to best meet the needs of the patient.

In addition, the adoption of intelligent dashboard at the nursing stations makes it convenient to transmit information. It saves the medical staff and scribes writing time, and reduces the amount of paper used. It also makes it possible to carry out the health education at the bedside, thus reducing the use of teaching materials and directly saving related costs for the hospital.

The iWard system also helps the management as well. After connecting the in-hospital systems, the iWard helps the hospital to better understand data, hospital bed placement and arrange cleaning tasks more efficiently after a patient is discharged from a hospital. As a result, the cleaning time is reduced from 30 minutes to about 22 minutes, allowing the next patient to be admitted sooner and smoothly, reducing the patient wait time.

Improvement of immediacy and the increase of patient satisfaction

For patients, the Advantech iWard solution provides convenience. The PIT system allows patients to receive more immediate care. In the past, patients seeking the assistant of nursing staff for supplements of fluid for



intravenous infusions, assistance in bowel movements, etc., needed to contact the nursing station through the traditional call bell, tell the staff their bed number and the details of their needs, and wait for the nursing staff to inform the nurse in charge. The average length of this process was up to 6.6 minutes, which is now shortened to 5.4 minutes, by using the PIT system. The PIT system not only saves the extra steps in communication, but can also directly contact the nurse in charge to reduce the cumbersome communication in between.

Chiu-Hsiang Lee also mentioned that patients have the right to know and the obligation to help confirm medical content. The “Medicine Information Display” of the PIT system allows patients to self-check the medications, display personalized medicines, and improve medication safety. In terms of medical treatment, if a doctor arranged an X-ray examination of a computed tomography (CT) scan in the past, a family members would be asked to go to the nursing station to check the results and relay the results to the patient, who could then get a general understanding of his or her condition indirectly. Alternatively, the doctor might to go the ward to tell the patient his or her own condition. In both cases, the patient still got an indirect or direct understanding of his or her condition. Now, the results can be directly displayed on the bedside screen by

the use of the PIT system, allowing the patient to learn more about his or her own condition.

In addition, Advantech’s iWard solution combined with the PIT system also functions to assist family members. As the family members may rotate to take care of the patient, some information may be lost during the handover process. Now, through the display of the bedside screen, the family members can avoid such losses and better understand information. Also, they will be more aware of the patient’s movements for examination and rehabilitation. Meanwhile, the patients do not have to worry about the confidentiality of their illness, which can be fully protected through the card function of the iWard system.

Intelligent medical care has become a new trend

Chiu-Hsiang Lee said that the hospital-based medical information system in the past has now evolved into a patient-centric care system, allowing patients to participate in medical care treatment programs. As it is a major trend to enhance the health care indicators for hospitalized patients, the Chung Shan Medical University Hospital decided to choose Advantech as their supplier in the design and construction of intelligent medical care system, as Advantech is very trustworthy in the hi-tech industry.

The hospital hopes that the intelligent system can be catered to their own style, with the cooperation of Advantech. Therefore, nurses are dispatched to discuss with the Advantech team different customizations that can accommodate the clinical information in a manner that suits both the viewpoints of the patients and the medical personnel. Meanwhile, Advantech has actively collaborated, in response to such needs, to test and adjust the system so as to provide customized services such as patient identification environmental introduction, health-education advocacy and cleaning system, so as to make the iWard solutions more and more perfect. At present, this iWard system is still in the optimization stage. In the future, the system will formulate a medical treatment plan for every patient to ensure the patient and their family members understand and participate in the entire medical decision-making process.

Interestingly, Chiu-Hsiang Lee mentioned that some patients expect that entertainment functions should be added in the PIT system, such as video games and Internet surfing. Not only does the feedback show that the application rate of the system is catching hold, but it also shows that intelligentization is a new trend that the medical industry cannot avoid. ■

All New 24" Surgical Monitor

Optimizing Display Quality with Precision



Advantech Kostec 24-inch widescreen medical-grade surgical monitor for medical applications to ensure operating precision

Designed to deliver medical images of optimal quality, the PAX-324 monitor supports a Full HD resolution of 1920x1200 @ 60 Hz. Equipped with REC709, True RGBs compliance & DICOM Part 14 GSDF compliance 14-bit LUT processing grayscale, hardware calibration support, and automatic charge input detection, the PAX-324 surgical monitor ensures precise representation of grayscale images and its slim true-flat design also offers physical onscreen display keys, a splash screen and an optional touchscreen with projective capacitive control, and can be upgraded into an IP-based monitor.



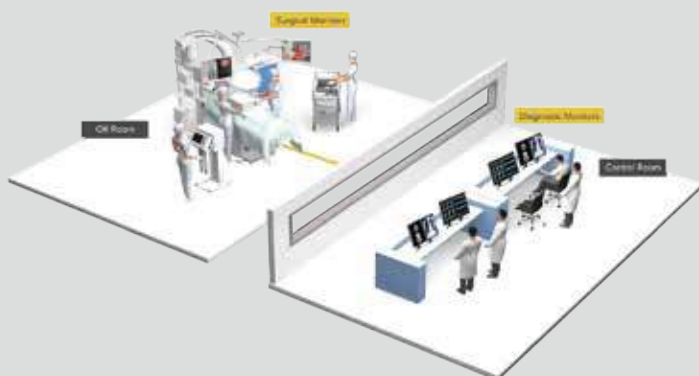
PAX-324



PAX-327



PAX-332



Wide Connectivities

Equipped with various analog and digital interfaces, including DP 1.2, HDMI 2.0, DVI-D Dual-Link. These monitors offer high connectivity for displaying images from various sources.



Full HD/Ultra HD (4K)

Available in a range of sizes and various performance levels. Including Full HD and 4K Ultra HD resolution.



Brightness Levelling Technology

BLT is an auto-sensing luminance technology that maintains screen brightness at the pre-calibrated maximum luminance level (Lmax) by consistently matching the just noticeable difference (JND) level for image quality.



12/14-bit LUT Grayscale

The 12/14-bit LUT grayscale is considered the color of light that the human eye is most sensitive to at the JND level. The use of 12/14-bit grayscale representation enables precise imaging for increased diagnostic accuracy.



DICOM Compliant

Ensuring grayscale of each monitor is compliant with DICOM Part 14 standard to provide the most accurate and consistent image quality over time.



Multiple Modalities

With widescreen high resolution format and multi input/output ports, KT-series of displays are excellent solutions for multi-tasking review in various medical applications.



Smart Healthcare Command Centers: Utilizing Data Integration to Improve Quality and Efficiency

By Pei-jun Liao with images provided by Advantech
Interview with Anita Lee, Advantech iHealthcare Sales Manager

Smart healthcare has become a top priority in the global healthcare industry in recent years. The application of new technologies such as cloud computing, IoT, data analysis, and AI to improve efficiency and quality of healthcare services is at the heart of smart healthcare. However, at present, smart healthcare applications primarily focus on medical treatment, e.g., using AI for medical image analysis and diagnosis. There are still relatively few applications that focus on healthcare management. This underlines the lack of attention to the contributions that management aspects can make to enhancing efficiency and quality of healthcare services.

According to Anita Lee, Sales Manager at Advantech

iHealthcare, healthcare management covers many different aspects, including not only human resources administration but also the functioning of hospital facilities and assessments of whether provided healthcare services meet regulatory standards and patient needs. To achieve high-quality healthcare management, data integration and real-time data visualization are vital.

When the manufacturing industry transitioned to industry 4.0, data on basic equipment, production, and factory environment was integrated in command centers, enabling supervisors to properly monitor the production status in their factories. Similarly, the healthcare industry should build data-driven smart healthcare command centers where all data related to medical equipment,

patient wards, outpatient clinics, the overall environment, and patients' physiological information are integrated on single platforms. Such platforms can provide meaningful and critical data for medical and administrative staff to make appropriate decisions.

Data-driven Healthcare: Smart Command Centers

Smart healthcare command centers must include hospital process management, real-time monitoring, and operational efficiency management.

With regard to hospital process management, four specific areas can be identified: outpatient clinics, patient wards, emergency rooms, and operating rooms. Operational efficiency of these areas will improve greatly through integrated data analysis. For example, resource management is one of the most important aspects of emergency rooms. In the event of a major car crash, for instance, emergency rooms could be confronted with a large number of patients in a short period of time. If medical resources are not readily available, treatment of patients could be affected. Integrating data on a single platform through a smart healthcare command center can be of great help to medical staff in utilizing resources.

The four main elements covered by real-time monitoring are indoor air quality, energy management, smart monitoring, and equipment location management. During the day, hospitals are filled with patients and their families and therefore require real-time monitoring and management to ensure smooth operations. For example, as the number of patients increases, the exhaust ventilation of air conditioning systems can be activated so that fresh air is brought into the building, the concentration of carbon dioxide is lowered, and indoor air quality is maintained. Efficiency can be further improved through location management systems that accurately keep track of medical equipment, so that medical staff can easily locate machines when needed.

Operational efficiency management covers hospital operation overview; financial analysis; the number of outpatients, inpatients, and emergency patients; and healthcare quality indices. Finding operational blind spots through data analysis can bolster healthcare quality and efficiency. Meanwhile, different healthcare quality indices exist for patients with acute, chronic or long-term conditions, such as nurse-patient ratios, nosocomial infection rate, bed occupancy rate, and patient fall rate. A smart healthcare command center can produce related statistics automatically, and also take

into account hospital accreditation standards to produce related reports and charts, which saves the hospital considerable time and effort in conducting accreditation procedures.

WISE-PaaS: Data Integration Platform for All Industries

Anita Lee emphasized that in order to create a data-driven smart healthcare command center, it is essential to integrate existing information systems such as PACS and HIS, build the center from the ground up, and collect patient and medical data through various kinds of sensors. Also, data storage and management standards must be clearly defined. Most importantly, users must carefully consider data application methods, i.e., which clinical systems and hospital management processes can be improved through the use of available data.

It is thus evident that data integration platforms are pivotal. Advantech's WISE-PaaS cloud platform, which was first used in the field of industrial IoT, has evolved to become an ideal solution for applications across sectors. The platform supports databases of different formats, as well as popular public cloud services such as Microsoft Azure, Amazon AWS, and Alibaba Cloud. In other words, in addition to a private cloud, healthcare users can opt to build their operation centers on public clouds, benefiting from the low costs and high flexibility of cloud services. The WISE-PaaS platform also provides a dashboard module that allows IT staff to easily visualize data and supervisors to instantly see important information.

Moreover, Advantech offers an industrial software and hardware integration solution—Solution Ready Package (SRP)—and data collection solution to help healthcare users comprehensively gather relevant data. For example, outpatient clinic registration solutions can collect data such as patient waiting and appointment times. And the smart ward solution can analyze when patients are likely to call nurses and for what reasons.

In the future, data will serve as the foundation of all applications. Although there are vast amounts of data in the healthcare sector, this data is often very fragmented and dispersed. By collecting information through sensors, integrating such information on a single platform, and visually presenting it through a smart healthcare command center, healthcare staff can quickly acquire meaningful information that enables them to improve the quality and efficiency of healthcare services. Indeed, this is the key purpose of a smart healthcare command center. ■

From Vertical to Parallel Integration, the Future Trends are Driven by Data

By Pei-jun Liao with images provided by Advantech
Interview with Eric Huang, General Manager of FYC

“Advantech has reliable hardware solutions and the reputable brand name, winning the trust of the hospitals. However, you must coordinate engineering with implementation in the construction of smart hospitals. This is where Advantech and FYC can complement each other. Now, FYC provides project and engineering management at the front end, while Advantech offers IT maintenance and after-sales service at the back end. Their combined services make the hospital feel reassured,” said Eric Huang, general manager of FYC Integration Engineering Co.

Seek similarities in differences and set standards from convergence

In the process of developing intelligent medical care, FYC is one of Advantech’s most valued partners, because FYC can provide a full range of professional intelligent medical solutions, ranging from planning to design to software integration to construction to warranty maintenance.

The first time FYC and Advantech worked together in the intelligent medical care space was when FYC received a case from Chang Gung Clinic several years ago. Eric Huang said that the special feature of this case was that it was the first professional medical institution built by Chang Gung outside the hospital group. It wanted to integrate smart building equipment management and intelligent medical solutions.

In order to meet Chang Gung Clinic’s requests, FYC compared the products available within the IT industry and found that most vendors could only meet one or two out of the many functions desired by Chang Gung.

There wasn’t anyone who was able to provide a complete platform to satisfy all the functions needed by Chang Gung. The only supplier in the industry that had such a platform was Advantech. As Advantech had the most complete stable solution and system, FYC chose to use Advantech’s energy management system as the platform to monitor all aspects for the clinic.

Mainly engaging in iWard applications in the field of intelligent medical care, FYC has since collaborated with Advantech to complete the installation of 1,5000 hospital beds in Taiwan, capturing the largest market share amongst Taiwanese companies. The application of the intelligent ward is mainly based on Advantech’s iWard SRP, which is built upon the foundation of the PIT. The PIT system includes the PIT bedside system, the PIT bedside card and the electronic dashboard microsystem at the nursing stations. In addition, customized services are provided to meet the individual needs of each hospital.

In fact, in the process of introducing intelligent medical care systems, there were many obstacles. In addition to the challenge imposed by remodeling relatively old buildings, it was also necessary to obtain the consensus of all units in industry of medical care.

For example, the case of constructing an intelligent ward system for the En Chu Kong Hospital, an older, medium sized building, involved an extensive range of challenges. Fortunately, FYC, which has had sufficient experience in engineering and communication, was able to give good advice to the hospital in the pre-planning stage. It required copious amounts of communication and coordination with many units in the hospital no



issues such as on-site environments and/or information engineering.

In the latter case, the detection system of preventing falls in the wards adopted by Taichung Veterans General Hospital is a good example.

Eric Huang further explained that the fall detection system focuses on the immediacy. After all, the nurses must take care of a large number of patients and cannot understand everything that is happening all at once. Thus, the detection system must act like several pairs of eyes to inform the medical staff to go to the aid of the patient at the first moments.

It was, however, a difficult issue to determine the location where the system should be installed. After discussing it with the hospital, it was decided that the system should be installed in the bathroom. The main reason was, that the patient having to get out of bed and go to the bathroom might suffer from sudden vertigo or faint due to medicines, various physiological reactions, or post-surgery complications. Therefore, there were many factors to consider, including the location of the device and the technology to be applied. “We can’t predict everything, but we can effectively help medical staff solve 70%-80% of their problems.”

Eric Huang said that the clients of FYC range from clinics and regional hospitals to large medical centers and institutions. Judging from his rich experience in assisting medical institutions to adopt intelligent medical systems for so many years, each and every hospital may vary in the application of systems due to its different specialization in the medical sector.

“In the past, we have encountered relatively big

issues. Every medical institution requires a certain degree of customization. Therefore, we have been studying in recent years with Advantech to find out similarities from differences and set standards from convergence. Of course, it takes time to hone the skills, but we believe we are going to make it sooner or later.”

Communication in a down-to-earth way to truly meet the customer’s needs

Why is the combination of two strong companies able to gain the trust of customers? According to Eric Huang, many people mistakenly think that intelligent medical care is a combination of “vendor A’s hardware + vendor B’s software” and then the product manager (PM) visits the hospital to talk about customization. However, Eric Huang admits, this model is very likely to end up in failure, mainly because the medical staff is too busy. If the PM is not professional enough to immediately grasp the opinions of the medical staff or quickly understand their implications, the hospital may not cooperate after a few rounds of meetings.

“Fortunately, colleagues from Advantech and FYC have rich experience in medical information, understand the hospital environment, and can quickly grasp the information expressed by the medical staff. As both sides use a common language, we can usually reach consensus quickly and provide the functions and services the hospital needs. This is the reason why the hospitals like to work with us,” said Eric Huang.

In the past, information systems were function-oriented. For example, the outpatient system, the inpatient system, the emergency system, the nursing information system, and the inspection information management system were all vertical. However, the first steps for the AI and BI is to replicate, to collect and to integrate. This is the value of the WISE-PaaS platform.

Secondly, the future smart healthcare application will be transformed into a data-driven concept. “Now we must think it over. Is it really suitable to adopt so many high technologies into medical treatment?” Eric Huang believes that the so-called intelligent medical care does not need overly complicated or cutting edge technologies, but it does need to truly understand and anticipate the needs of the users and satisfy those needs in a practical, user-friendly manner. This is the key that FYC and Advantech can deepen their roots in the field, and capture the largest share in the market as leaders. ■



Advantech's WISE-PaaS Platform Wins Favor in HIMSS & Health 2.0 Conference

In this year's conference for the Healthcare Information and Management Systems Society (HIMSS) & Health 2.0 held in Helsinki, Finland, the Advantech Corporation invited its partners and customers to learn more about the WISE-PaaS platform and the success stories of customers using the platform. At the same time, customers were invited to learn more about Advantech's complete medical product portfolio (POC, HIT, PAX, AMiS, etc.) and to understand the future healthcare solutions that the WISE-PaaS and the Advantech will carry out. Members attending the HIMSS & Health 2.0 conference included healthcare decision makers, patients, clinicians, nurses, life science professionals and innovators, and other influencers. This was an important indicator meeting within the healthcare ecosystem.

Advantech's Smart Medical System Came Out Strong in the 2019 Dubai Health Medical Exhibition



At the 2019 Dubai Health Medical Exhibition, Advantech wowed audiences with a variety of smart medical software and hardware facilities. These included integrated nursing vehicles, mobile clinical assistants, and multi-functional bedside nursing information systems. There was also the intelligent ward system that interconnects the wards with the nursing stations, mobile devices, and equipment and remote management systems. The presentations fully demonstrated the strong position held by the Advantech Corporation in the global medical computer markets. Their Smart Medical System also attracted the attention and favor of many manufacturers and partners from different countries. ■



Medical Computer Cart



Touch Computer &
Reliable Power Supply



Safety & Infection
Control



Great Flexibility with
Modular Design



Medical Safety
Certified



High-quality
Battery



Remote Management
Software

Intelligent Power System

Intelligent Medical Cart

Nurses and other healthcare professionals spend nearly 90% of their time moving from place to place as they provide care to patients, moving from nursing stations, to wards, to patient rooms. Currently most hospitals are struggling with makeshift carts, strapping desktop computers or laptops on board and rolling them from place to place. However, usually these carts with wires tie-wrapped or wound about legs, have issues with cleaning, power and working space. Mobile Point-of-Care systems are designed to move with busy healthcare professionals. They use wireless infrastructure, mobile devices and specialized applications to meet the needs of caregivers.



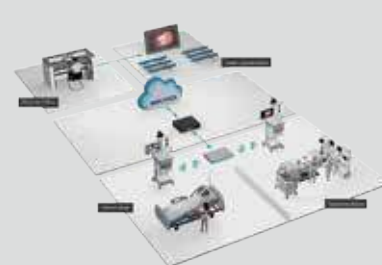
Perioperative Information Systems in Operating Room Environments

Closed loop medication administration (CLMA) is a workflow improvement process that involves electronic medication management for seamless information integration. The CLMA process provides a traceable information flow from the prescribing doctor, through to the pharmacy, nursing station, and patient wards. CLMA minimizes inpatient medication errors and increases overall patient safety.



Vital Signs Measurement and Monitoring

Vital sign monitors can be integrated with mobile workstations, medical carts, and tablets for easy access and management. Patients' real-time vital sign data can then be automatically transmitted to the hospital information system (HIS) or nursing information system (NIS) via a cable or Bluetooth. This allows caregivers to monitor patients' status remotely. Nurses can also use a medical tablet to access and update patient data, and provide superior care and treatment.



Telemedicine

The evolution of telecommunication and information technologies has enabled clinicians to evaluate, diagnose, and even treat patients remotely. Telemedicine can be used to save the lives of people living in rural communities, under critical care, or in emergency situations. Using telemedicine carts and portable devices, healthcare professionals can also exchange diagnosis, treatment, research, and evaluation information to inform, educate, and improve public health.



Realize Digital Transformation with AIoT and WISE-PaaS



Advantech IoT Co-Creation Partner Conference

How

Join the Conference
the Way You Prefer

1. Offline Conferences
2. Online Webinars

Where

G. China	Asia Pacific	Europe / US
Taipei, Taiwan	Sydney, Australia	Philadelphia, USA
Kunshan, China	Tokyo, Japan	Louisville, USA
Wuhan, China	Nagoya, Japan	Munich, Germany
Tsingtao, China	Seoul, Korea	Barcelona, Spain

What

Learn Your Interested
Sectors and Solutions

1. Industrial IoT & Industry 4.0
2. iFactory
3. Edge Intelligence and AI
4. Energy & Environment
5. Smart City
6. iHealthcare
7. iRetail & iLogistics

