

DAS (Digital, Automated, and Smart) 2.0: A Framework for the Intelligent CSSD

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Honjo Medical

April 16, 2024, HongKong

About Myself



Education

- **Bachelor:** Mechanical Engineering, Tongji University
- **EMBA:** Mannheim University + Tongji University



Career

- **Customer Service Technician:** Getinge China (1999-2006)
- **Division Leader:** Sinopharm Meditech (2007-2014)
- **Founder:** Honjo Medical (2015 -)

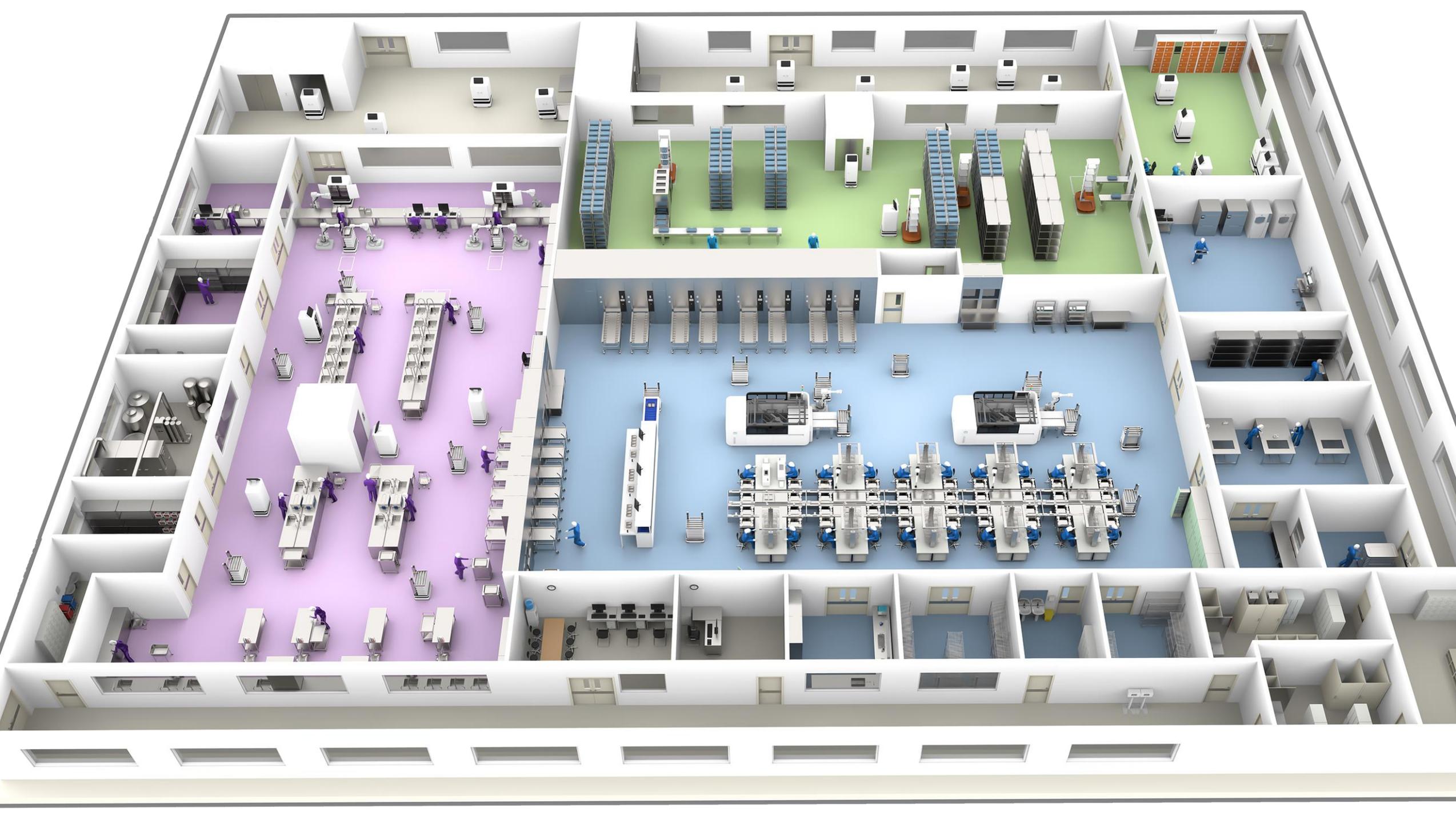
Honjo Medical



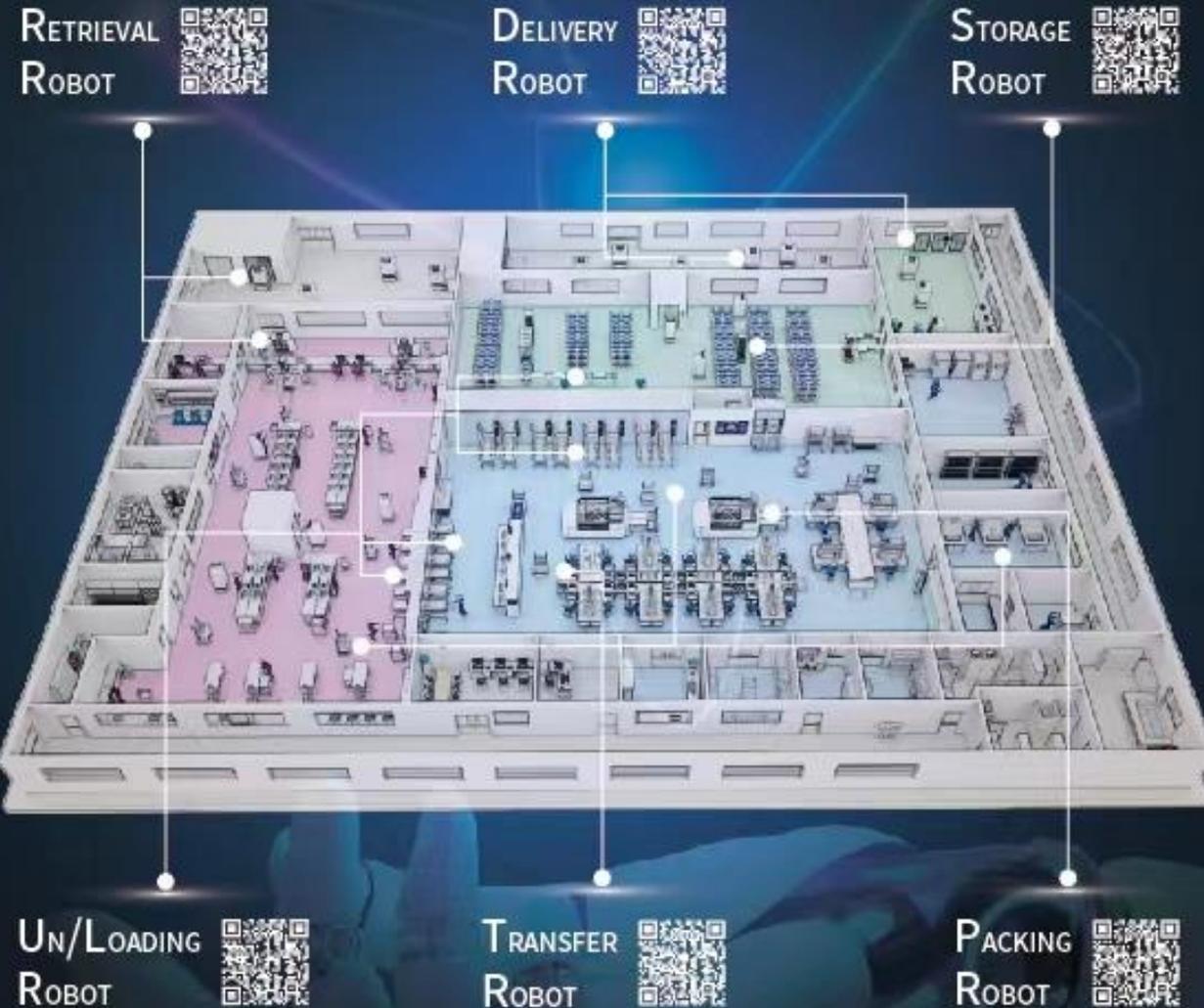
Mission: WITH CSSD, FOR CSSD



Solutions: Intelligent CSSD Solution (Software, Robots, smart devices...)



Want to #SPDRobots? Come to #Honjo!



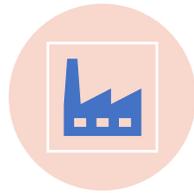
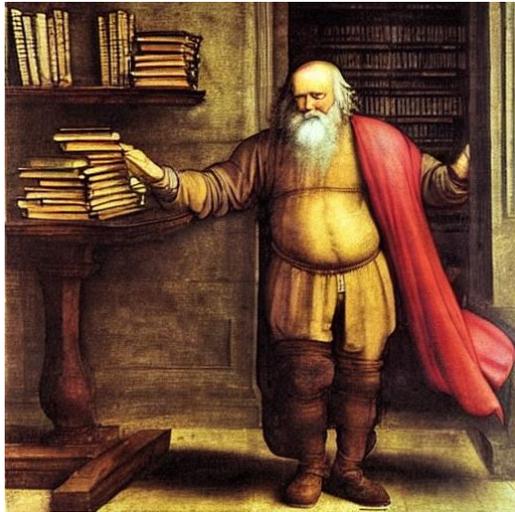
2.0 vs 1.0

		DAS 1.0	DAS 2.0
Research purpose		To complete my graduation thesis	To upgrade DAS 1.0
Research period		2022.03 - 2022.10	2023.07 - 2023.09
Research theory		DAS Framework by Robert Boute and Jan Meighem	
Research approaches		Literature Review Approach (LRA) Industrial Players Approach (IPA) Pioneering Practitioners Approach (PPA)	
LRA	Studied Literature	23	24
	Identified Solutions	9	21
IPA	Selected Companies	31	76
	Identified Solutions	14	42
PPA	Selected videos	13	161
	Identified Solutions	13	37
Total Identified Solutions		36	100
After eliminating the overlapped solutions		24	60

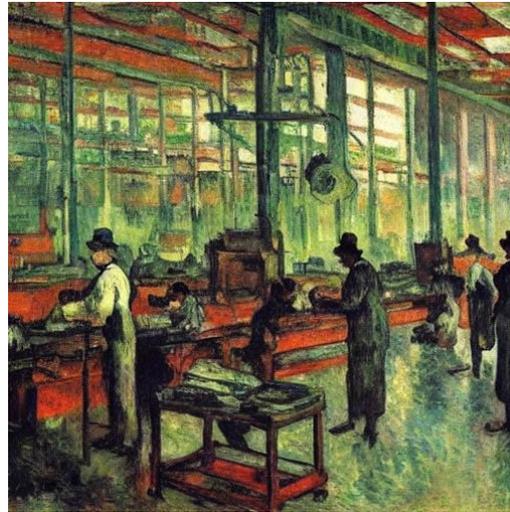
Research Approaches



Approach I:
Literature Review



Approach II:
Industrial Players



Approach III:
Pioneering
Practitioners



- Note: All pictures in this page are created by Artificial Intelligence (AI).

Literature Review Approach (LRA)



- **Database:** Scopus, Web of Science, PubMed via Medline
- **Methodology:** Preferred Reporting Items for Systematic Reviews and Meta-Analyses Statement (PRISMA)
- **Studied Literature:** 24
- **Identified Solutions:** 21

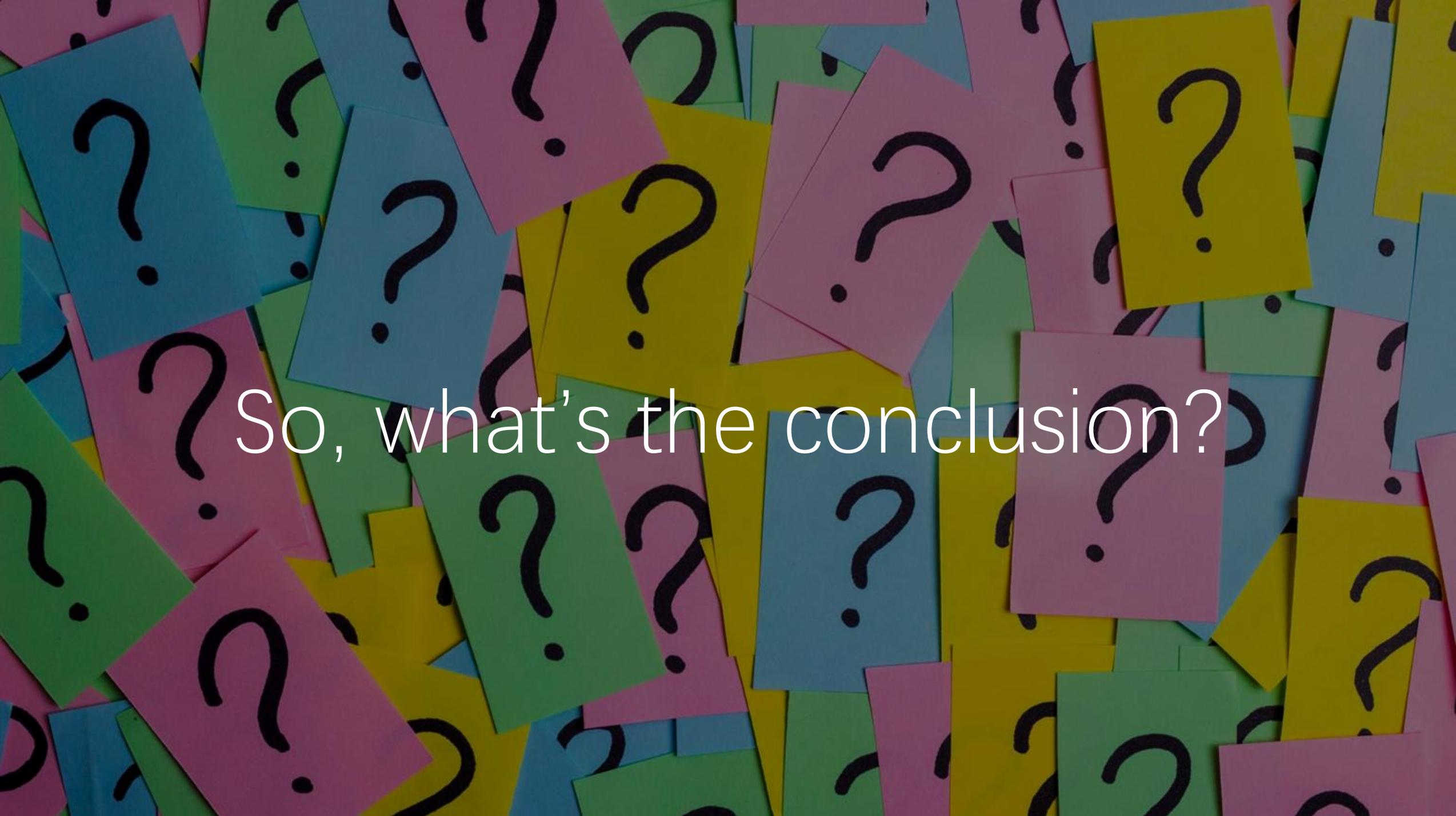
Industrial Players Approach (IPA)



- **Sources:** WFHSS/HSPA/MEDICA/CMEF/ARAB HEALTH exhibitors in recent 3 years
- **Total Number:** 307
- **Selected Companies:** 76
- **Identified Solutions:** 42

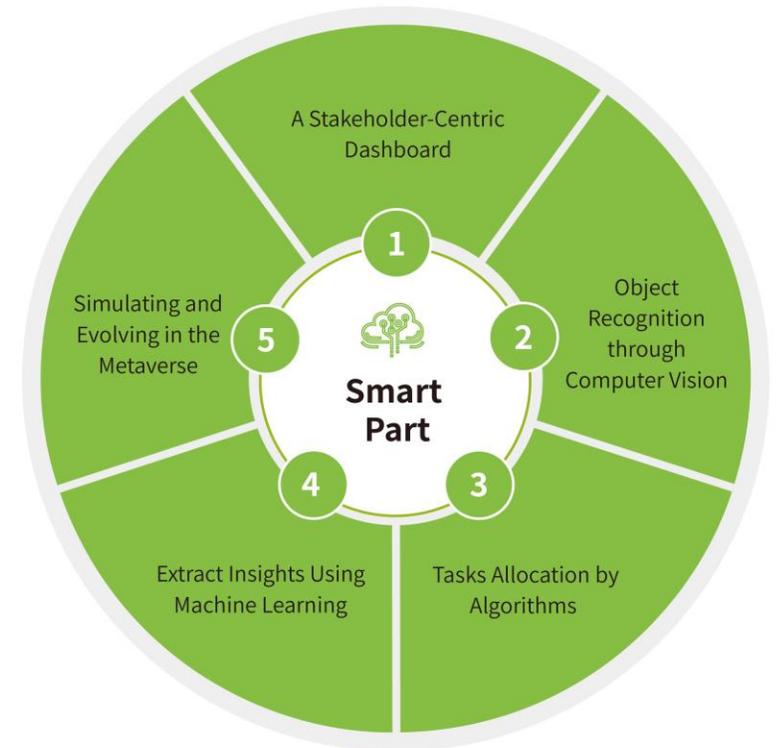
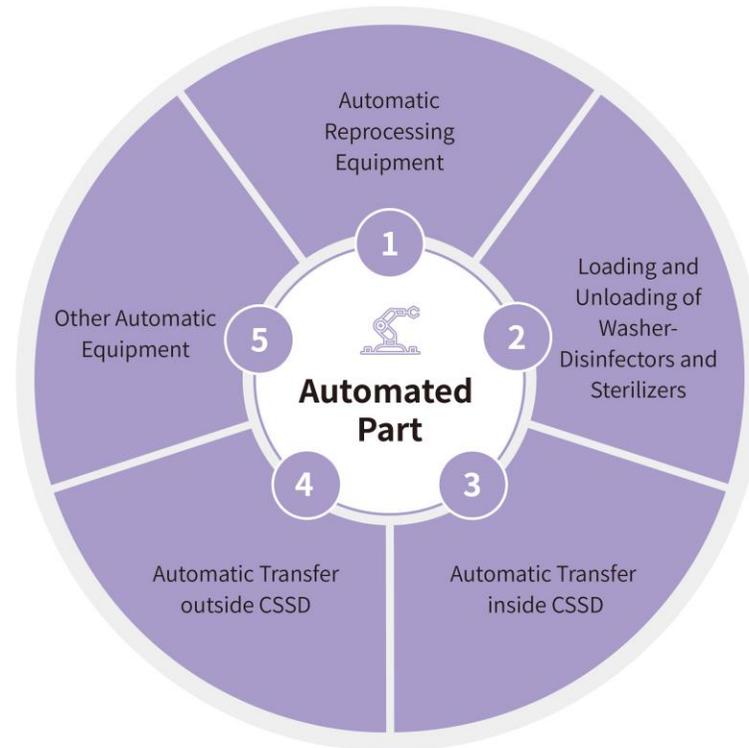
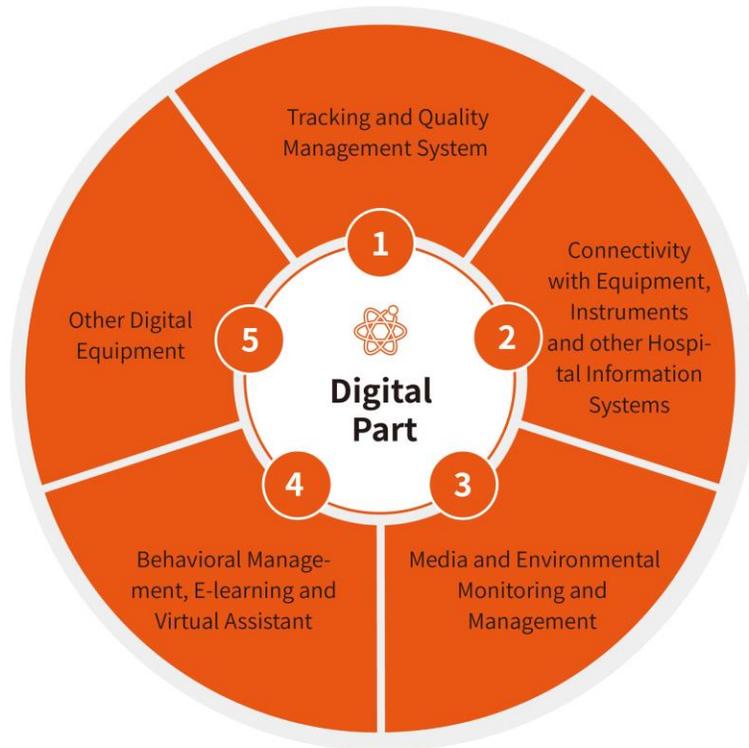
Pioneering Practitioners Approach (PPA)

- **Sources:** Search keywords of "CSSD", "SPD", "MDRD", "AEMP", "RuMED", "Stérilisation centrale", "消毒供应中心", "中央材料室", 중앙공급실, قسم التعقيم المركزي from YouTube
- **Total Number:** 189 videos from 168 hospitals in 21 countries
- **Selected videos:** 161
- **Identified Solutions:** 37

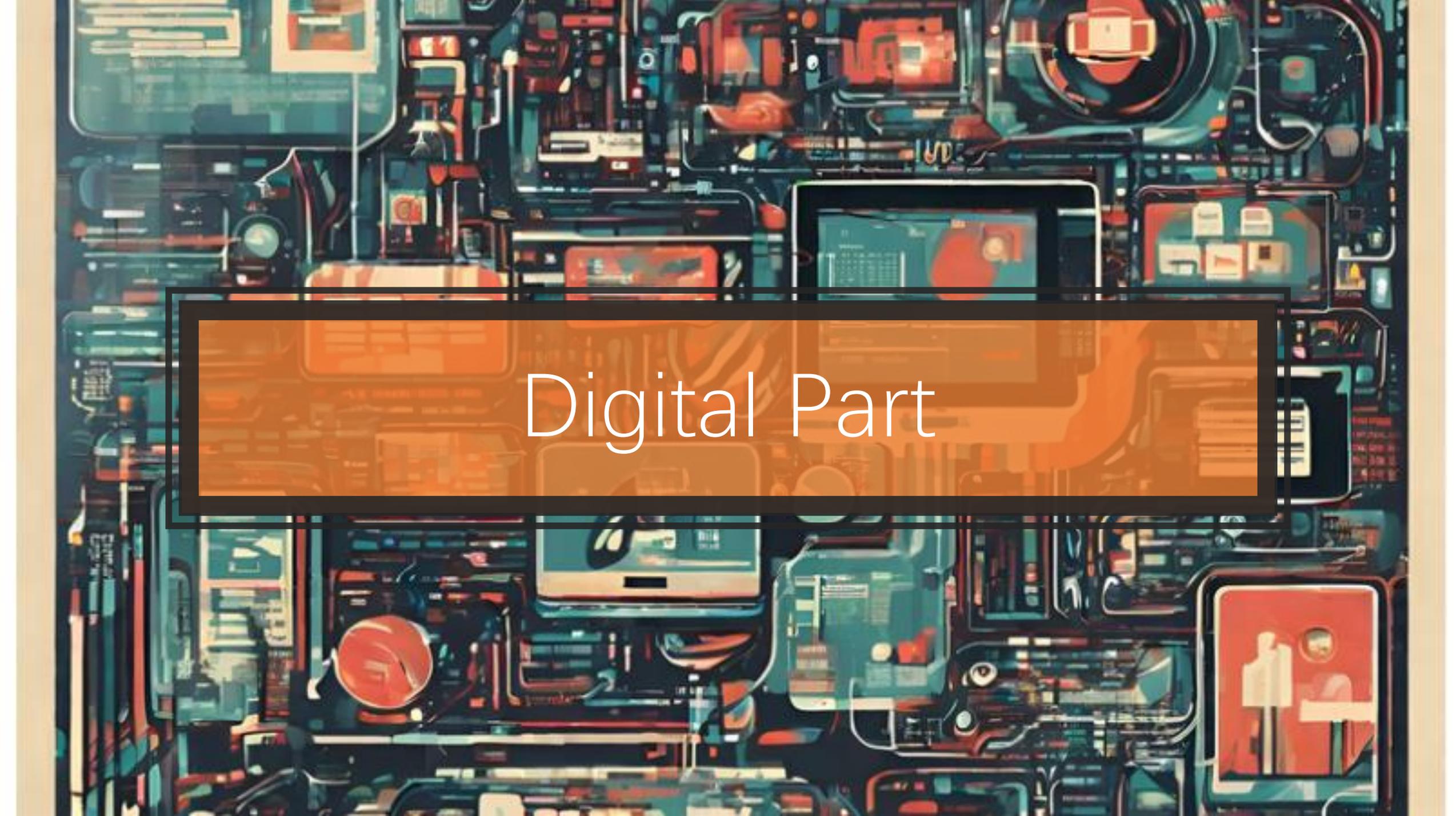


So, what's the conclusion?

DAS 2.0: A Framework for Intelligent CSSD



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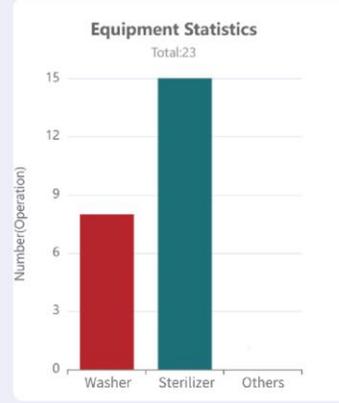
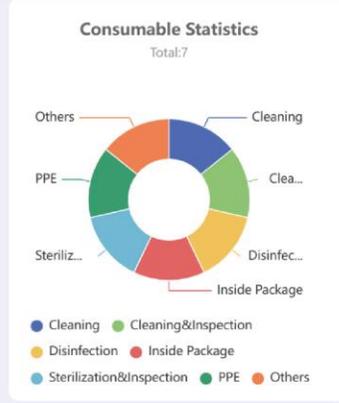
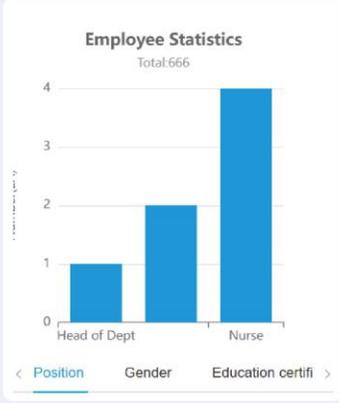


Digital Part

Element 1: Tracking and Quality Management System

- **Sterile processing tracking and quality management system**
- **Dedicated processing software and plug-ins**
 - Endoscope reprocessing software
 - Loan surgical instruments and implants management and reprocessing system
 - Inventory management system
 - Warehouse management system (WMS)
 - etc.

- Master Data
- Warehouse Mgt.
- CSSD QCI
- Decontamination Area
- Inspec.&Packing Area
- Sterile storage area
- Report
- Survey
- Dashboard
- Loan Gear Mgt.
- Department Mgt.

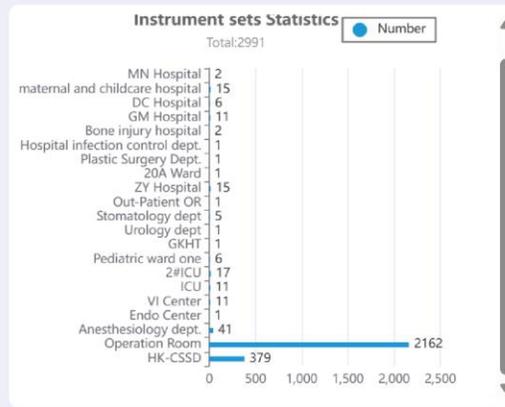
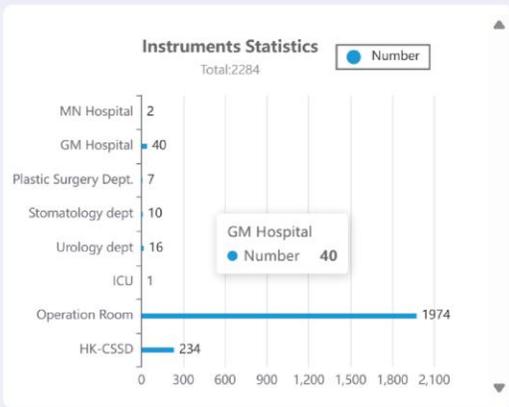


666 User

2284 Instruments

2991 Instrument sets

23 Equipment



Element 2: Connectivity with Equipment, Instruments and other Hospital Information Systems

- **Connectivity with equipment**
 - Washer-Disinfectors
 - High temperature steam sterilizers
 - Low temperature sterilizers
 - Ultrasonics, Drying cabinet, Sealing machine, Insulation tester, Incubator, Hot air sterilizer, etc.
- **Connectivity with instruments**
 - 1 Dimension barcode
 - **2 Dimension barcode / Data Matrix**
 - **Radio Frequency Identification (RFID)**
 - Others
- **Connectivity with other Hospital Information Systems**
 - Patient administration
 - Surgical schedule
 - Electronic Medical Record (EMR)
 - Billing system
 - Assets management
 - Office Automation (OA)
 - Human Resource (HR)
 - etc.

器械名 请输入器械名

SD管理

数据

区

查包装及灭菌区

物品存放区

器械管理

工作量查询

#	
1	
2	
3	
4	
5	
6	

自包明细

包名称 **胸科器械-11** 包码 **125100262** 包装时间 **2021-08-26 11:44:07** 包装人 **苏慧** 审核人 **honjo**

灭菌人 **苏慧** 灭菌时间 **2021-08-23 10:09:50** 设备 **2号洁定高温灭菌器** 程序 **P1重载器械** 批次 **1**

发放人 **honjo** 发放时间 **2021-08-26 11:47:50** 科室 **手术室**

器械名	器械码	数量
16cm组织剪	HONJO2021082601	1
14cm持针钳	HONJO2021082602	1
长直止血钳	HONJO2021082603	1
25cm弯有钩止血钳	HONJO2021082604	1
探钩	HONJO2021082605	1



Element 3: Media and Environmental Monitoring and Management

- **Media parameters**

- Water
- Steam
- **Non-Condensable Gases (NCGs)**
- Compressed Air
- Electricity
- etc.

- **Environmental parameters**

- Temperature
- Humidity
- Air cleanliness class
- Ventilation rate
- Residue harmful gases (e.g., Ethylene oxide, Hydrogen peroxide, etc.)
- etc.

Element 4: Behavioral Management, E-learning and Virtual Assistant

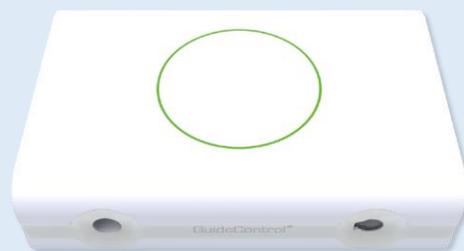
- **Behavioral management**
 - Access by chip card control, fingerprint, facial recognition ...
 - Videorecording during key activities, e.g., instruments handover, packaging ...
 - Hand hygiene compliance system
 - etc.
- **E-learning and virtual assistant**
 - On-line courses
 - Virtual classroom
 - Electrical Instruction for Use (IFU)
 - Video guidance
 - **Augmented Reality (AR) gadgets**
 - **Virtual Reality (VR) tools**
 - etc.

Element 5: Other Digital Equipment

- **Digital equipment**
 - Digital BD test
 - Datalogger
 - Digital high-resolution inspection apparatus
 - **Automated rigid endoscope tester**
 - Electronic air leak detector for flexible endoscope
 - Digital light guide cable tester
 - etc.



全自动硬式内镜检测仪



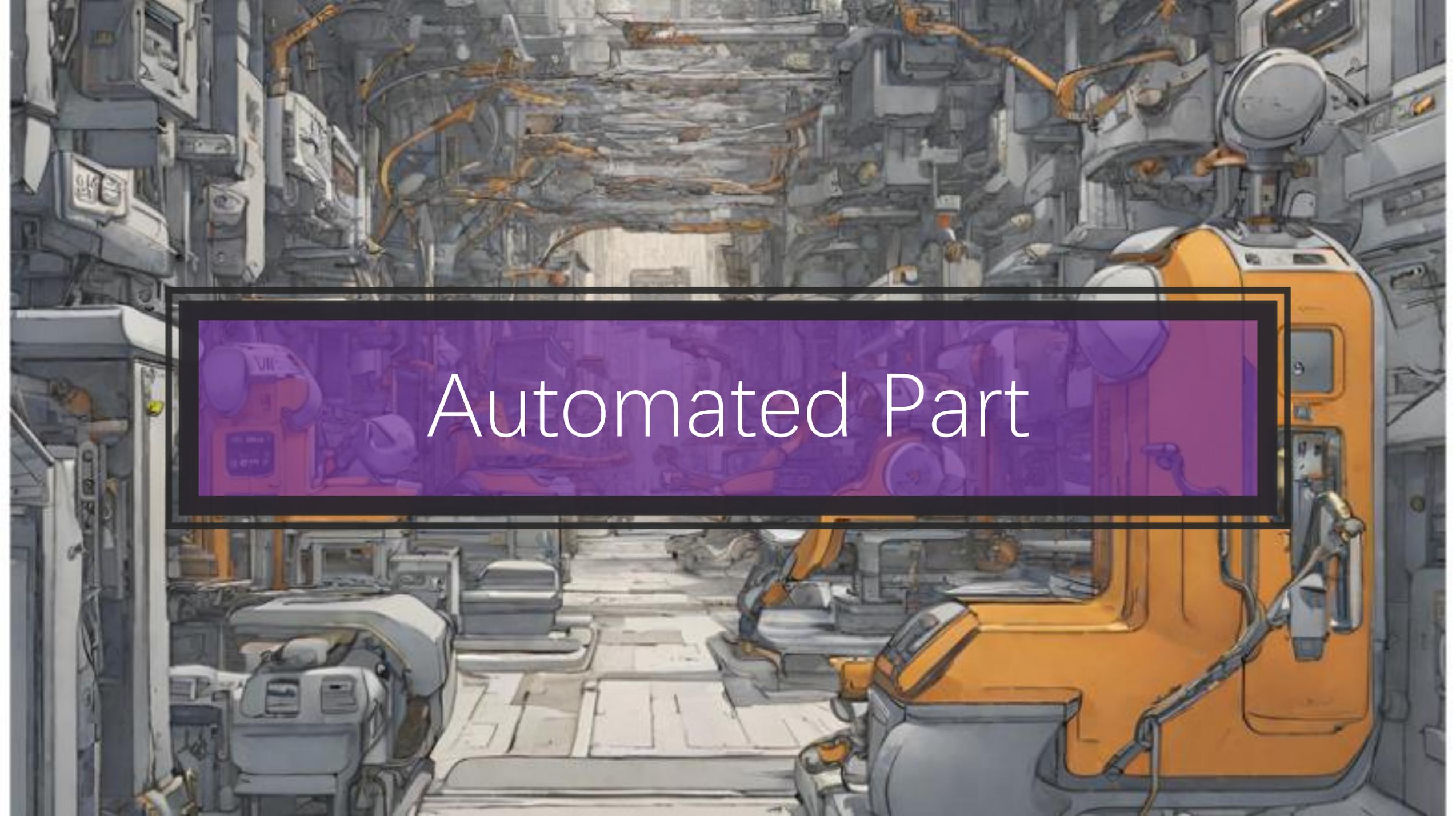
导光束测试仪



二维码识别器



硬式内镜管理软件界面



Automated Part

Element 1: Automatic Reprocessing Equipment

- **Automatic reprocessing equipment**
 - Washer-Disinfector
 - High temperature steam sterilizer
 - Low temperature sterilizer
 - Ultrasonics, Drying cabinet, Sealing machine, Insulation tester, Incubator, etc.

Element 2: Loading and Unloading of Washer-Disinfectors and Sterilizers

- **Loading and unloading of Washer-Disinfectors and Sterilizers**
 - Automated Guided Vehicle (AGV)
 - Autonomous Mobile Robot (AMR)
 - **Automatic loading/unloading station**
 - **Automatic loading/unloading system**
 - Electric height adjustable loading/unloading trolley
 - etc.

Element 3: Automatic Transfer inside CSSD

- **Automatic transfer inside CSSD**
 - Automated Guided Vehicle (AGV)
 - **Autonomous Mobile Robot (AMR)**
 - Conveyor belt
 - Roller belt
 - Robotic arms & grippers
 - etc.

Element 4: Automatic Transfer outside CSSD

- **Automatic transfer outside CSSD**
 - Automated Guided Vehicle (AGV)
 - **Autonomous Mobile Robot (AMR)**
 - Pneumatic tube logistics system
 - Box/Case logistics transmission system
 - Guide rail transmission system
 - Electric trailer
 - etc.

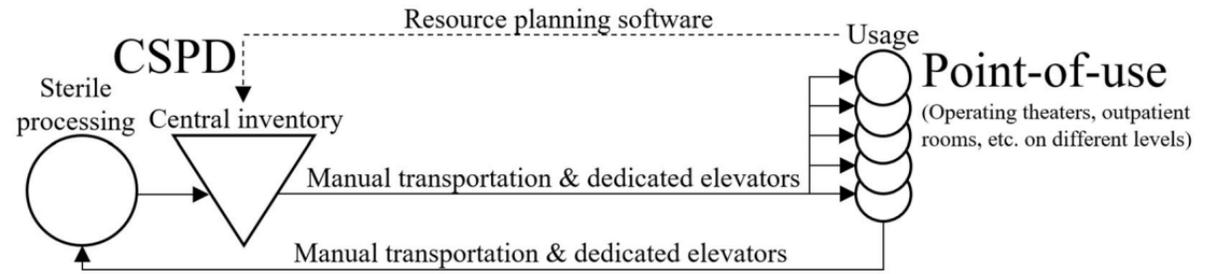


Figure 1. Control model of sterile instrument logistics in Hospital A.

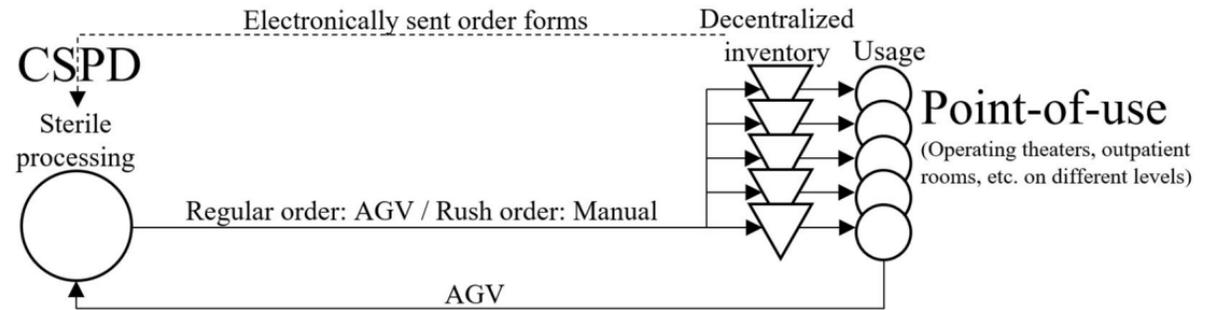


Figure 2. Control model of sterile instrument logistics in Hospital B.

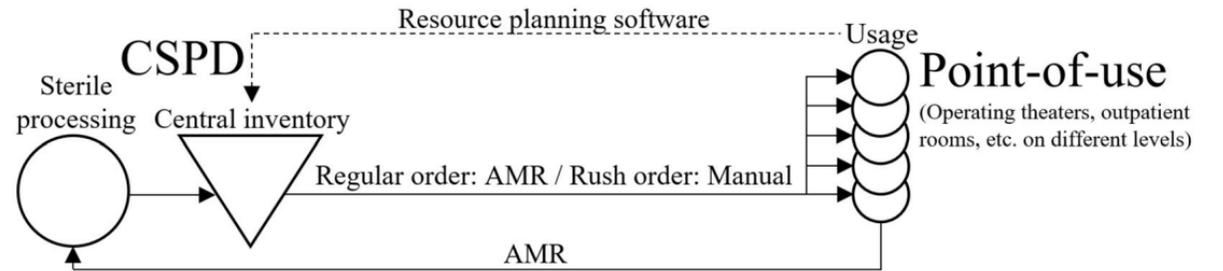


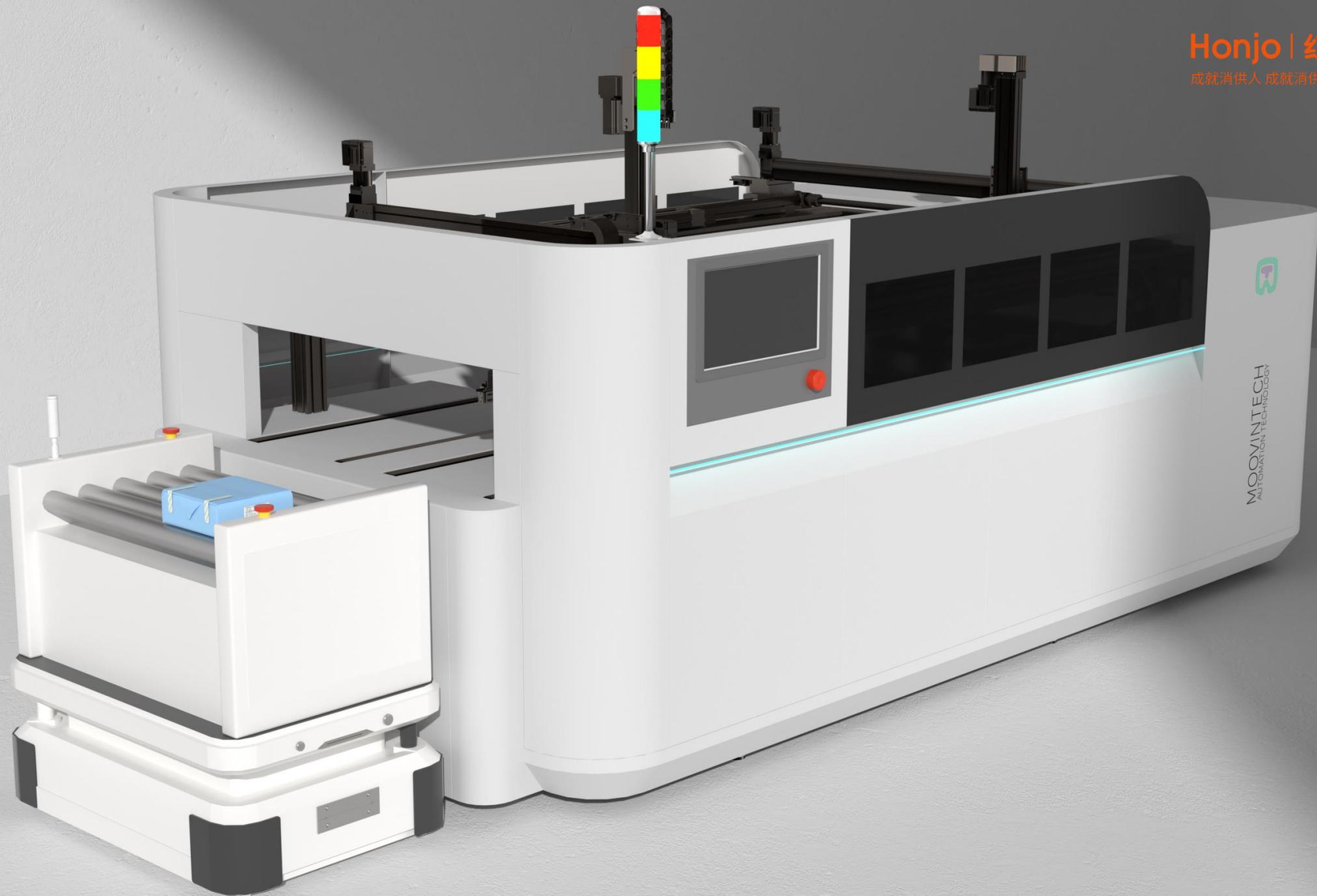
Figure 3. Control model of sterile instrument logistics in Hospital C.

Element 5: Other Automatic Equipment

- **Other automatic equipment**
 - Central dosing system
 - Cooling accelerator
 - **Robotic packing machine**
 - Vertical storage system
 - Leakage test system
 - Robotic arm and gripper to handle the instruments and sets, like checking, assembling, pick-up, and so on
 - etc.

Honjo | 红柚医疗

成就消供人 成就消供事 成就消供梦



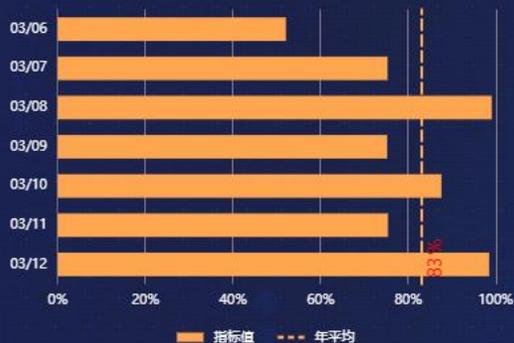
A futuristic industrial setting, possibly a factory or a space station. In the foreground, a woman with blonde hair is wearing a white, high-tech helmet with a circular sensor on the side. She is looking upwards and to the right. The background is filled with complex machinery, pipes, and structural elements. A large, circular, metallic structure is visible in the upper center. The overall atmosphere is one of advanced technology and industrial activity. A large green banner with a black border is overlaid in the center, containing the text "Smart Part" in white, sans-serif font.

Smart Part

Element 1: A Stakeholder-Centric Dashboard

- **A stakeholder-centric dashboard**
 - **Basic facts/figures of CSSD**
 - Completed workload
 - Unfinished workload
 - Real time status of Washer-Disinfectors and Sterilizers
 - Real time status of various robots
 - Other Key Performance Indicators (KPIs)

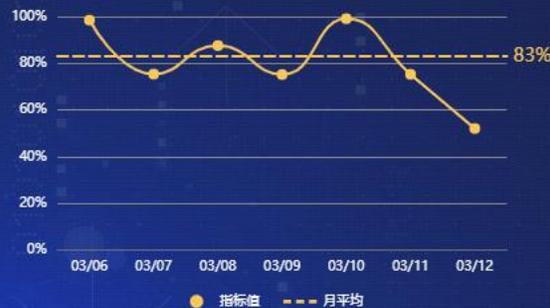
清洗合格率（日常）



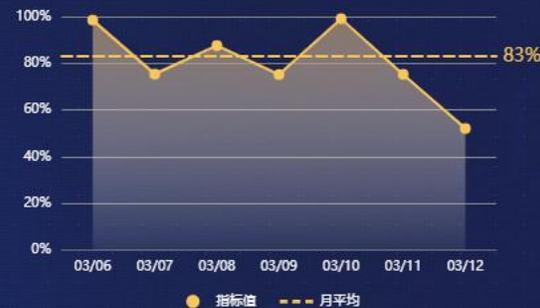
结构指标



包装合格率



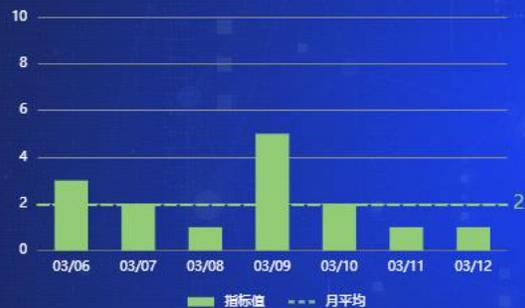
湿包发生率



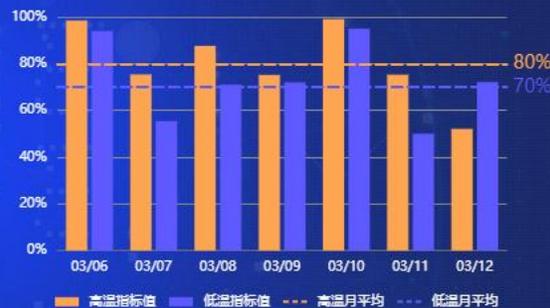
清洗合格率（抽查）



灭菌程序选择错误次数



灭菌装载合格率

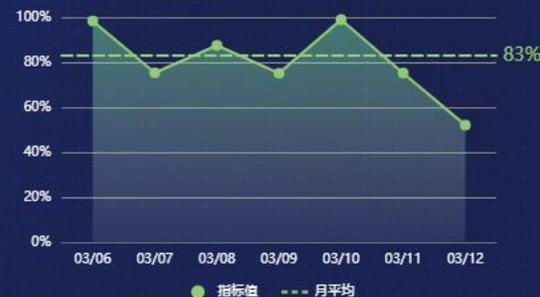


灭菌效果监测合格率



工作区域	时间	问题登记	不合格类型	名称
包装区	2023/02/28	化学指示物放置不正确	1类	剖宫产器械包
包装区	2023/02/28	包外标识信息有涂改	3类	宫腔全子宫包
包装区	2023/02/28	化学指示物放置不正确	1类	开颅探查包
包装区	2023/02/28	包外标识信息有涂改	3类	单包眼科剪
包装区	2023/02/28	化学指示物放置不正确	1类	新阴式全宫包
包装区	2023/02/28	包外标识信息有涂改	3类	剖腹探查包
包装区	2023/02/28	包外标识信息有涂改	3类	剖腹探查包

发放合格率



Element 2: Object Recognition through Computer Vision

- **Object recognition through computer vision**
 - To identify different instruments for learning/recognizing
 - **To identify different instruments for classifying**
 - **To identify different instruments for assembling**
 - To inspect the cleaning quality
 - To detect the functional defects
 - etc.

Element 3: Tasks Allocation by Algorithms

- **Tasks allocation by algorithms**
 - To improve/maximize the operations of Washer-Disinfectors
 - To improve/maximize the operations of Sterilizers
 - **To assign working tasks to different personnel**
 - To assign working tasks to different robots
 - Prioritize the reprocessing of instruments/sets that are urgently called for
 - etc.

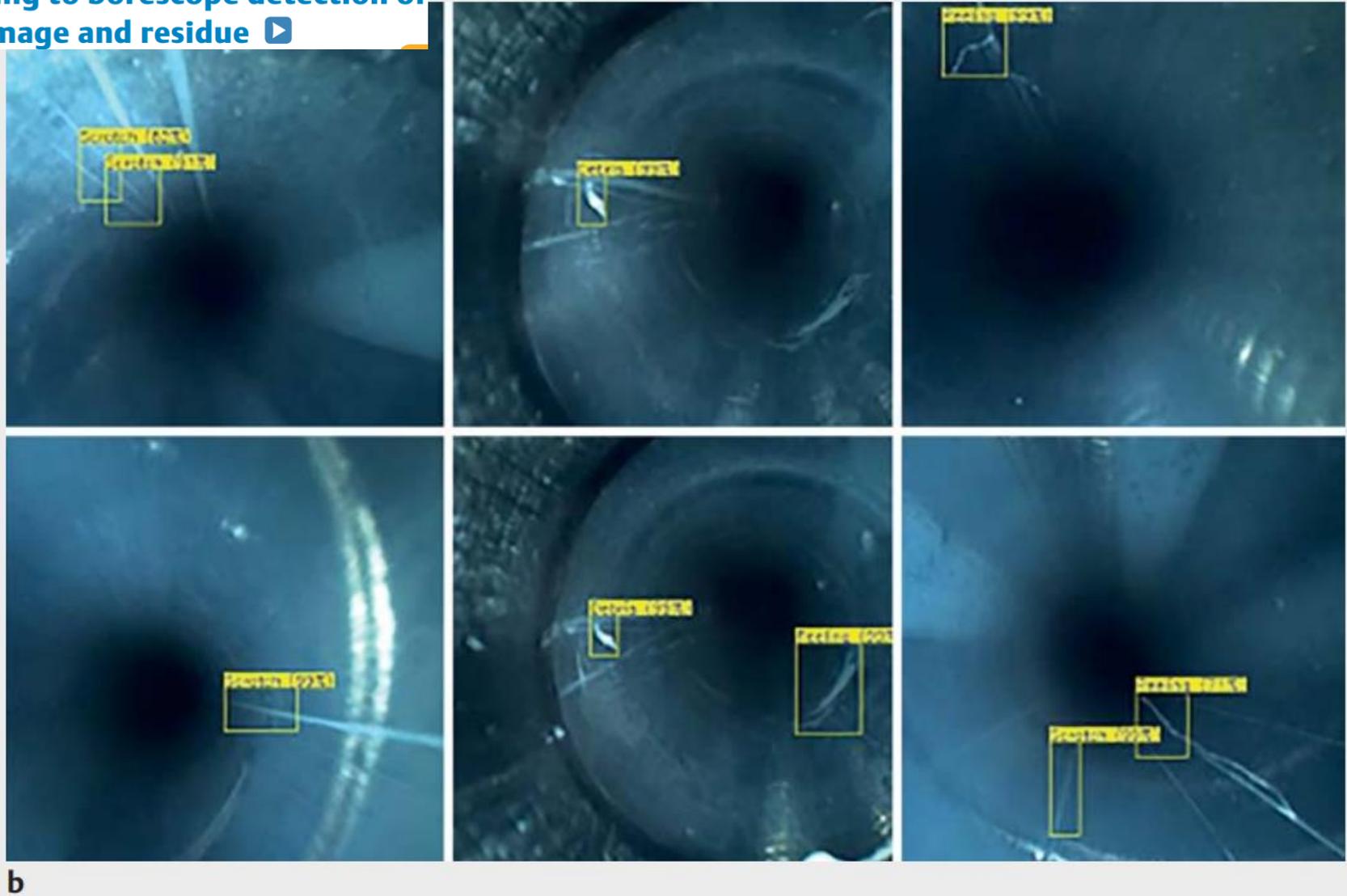
Element 4: Extract Insights Using Machine Learning

- **Extract insights using machine learning**
 - Using machine learning to obtain performance reports on equipment, e.g. Washer-Disinfectors, sterilizers, ...
 - **Using machine learning to check/detect the functionality of medical instruments**
 - Using machine learning to obtain performance reports on personnel
 - Using machine learning to obtain comprehensive reports on department
 - etc.

Initial application of deep learning to borescope detection of endoscope working channel damage and residue ▶

Endoscope working channel finding labels

- Irregularity
- droplet
- peeling
- debris
- scratch
- stain
- perforation



a

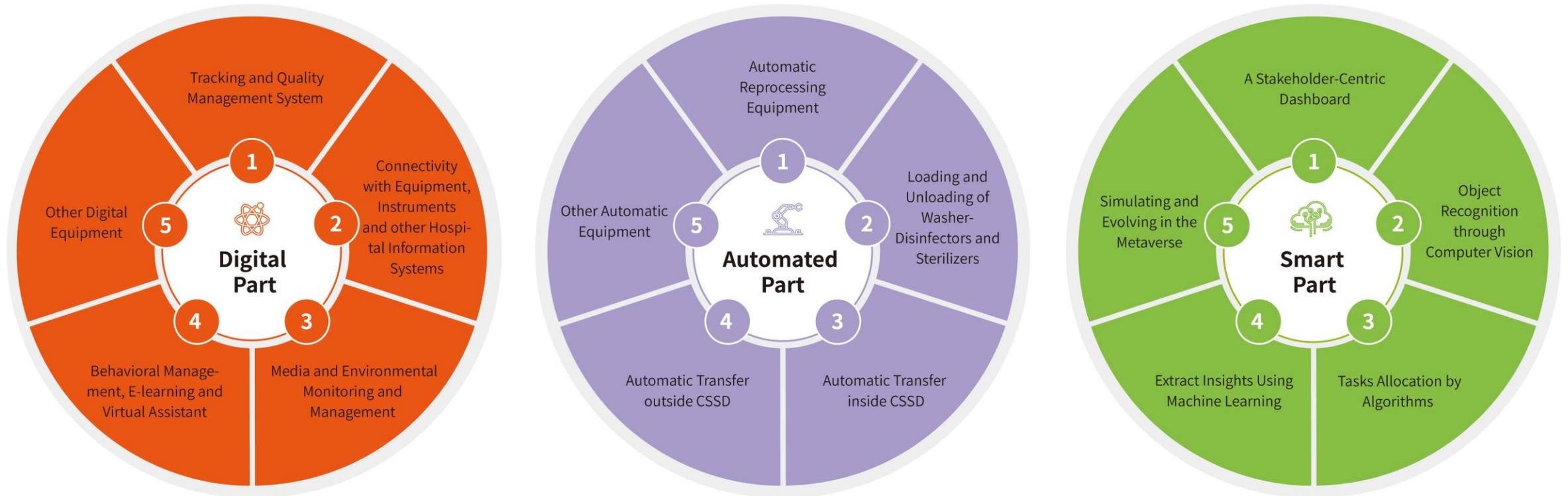
b

▶ **Fig. 1** a List of working channel finding labels included in the AI algorithm. b Sample images of deep learning algorithm-detected findings within endoscope working channels. A square depicts the finding, a label is applied to the finding and a percentage certainty is associated with the finding.

Element 5: Simulating and Evolving in the Metaverse

- **Simulating and Evolving in the Metaverse**
 - Creating digital twins for all 4M1E that related to CSSD
 - ✓ Man/People
 - ✓ Machines
 - ✓ Materials
 - ✓ Methods
 - ✓ Environment
 - More real-time and more precise, resulting in more optimized results
 - The digital world evolves, showcasing a possible future

DAS 2.0: A Framework for Intelligent CSSD



DAS 2.0: A Framework for Intelligent CSSD

What can we do with DAS 2.0?

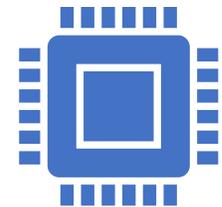


It's a TOOL for comparing the intelligent levels of different CSSDs horizontally and vertically.



It's a MAP for planning a new CSSD, re-structuring or digitally transforming an existing CSSD.

DAS 2.0 is our PRINCIPAL of developing intelligent products and solutions for CSSD.



Honjo

WITH CSSD, FOR CSSD!

Thanks for your attention!

I am reached by



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jim.chin@honjomed.com