

Revolutionizing Hospital Sterilization: Harnessing AI, Industrial Insights and Digital Transformation

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Agenda



- What's Digital Transformation ?
 - Digital maturity assessment tools
 - Benefits
- What's Artificial Intelligence ?
 - Demystifying Al
 - Link with Digital Technologies of the Future
- Use cases in AI for Hospital Sterilization
- Conclusion









- Competitiveness
- Attractiveness of the company
- Advanced Process Automation
- Employee Empowerment
- Cost reduction
- Reduced production cycle time
- Reduced complexity
- Improvement in performance, quality and compliance rate
- Reduction in the arduousness of certain tasks
- Improved reliability, robustness
- Resource saving
- Emissions reduction
- ...







Artificial Intelligence





https://medium.com/datadriveninvestor/artificial-intelligence-vs-machinelearning-vs-deep-learning-vs-data-science-2183ac856368 The theory and development of computer systems able to perform tasks normally requiring human intelligence...

Al is a collection of tools, including supervised learning, unsupervised learning, reinforcement learning, and now generative Al. All of these are general-purpose technologies, meaning that — similar to other general-purpose technologies like electricity and the internet they are useful for many different tasks. Andrew Ng, DeepLearning.Al

Demystifying



Artificial Intelligence



« Dall-e, « ChatGPT » Midjourney » TTS / STT Computer **Generative AI** Vision NLP Deep Learning Recommender Reinforcement Systems Learning Machine Learning **Statistics** Optimisation Algorithms 110.00 0.00

Demystifying



Artificial Intelligence



Demystifying





Digital Technologies of the Future

- Data Processing and Data & Analytics
- Digital Twin and simulation
- Artificial Intelligence
- High Performance Computing
- Internet of Things (IoT) and sensors
- Electronic and computer components
- Robotics and automation
- 3D printing
- Augmented and Virtual Reality (AR/VR)
- Blockchain
- Advanced Interfacing and Interoperability

https://www.digitalwallonia.be/fr/publications/recherche-industrie-futur/











AI for Hospital Sterilization



Use Cases :

- Digital Twin for Sterilization Process
- Smart Monitoring
- Assessment of AR Solution for Reconditioning
- Predictive Maintenance and Energy Efficiency
- Robot, Cobot and AGV
- Operating Room Schedule Optimizer



Al for Hospital Sterilization Digital Twin



Process Improvment How to improve hospital sterilization process?

Sterilization must guarantee the quality of its process and **control the sterilization cycle time** to ensure high availability of instrument sets Process modelisation, Simulator, Digital Twin !!!



WFHSS 2022 O. Willième Modeling a Tool for planning a new CSSD done by www.cetic.be

Statistics : ~4000 sets from 3 hospitals from 1 to 100 instruments by set



nb of instruments by set



Al for Hospital Sterilization Digital Twin







Al for Hospital Sterilization Digital Twin



What was done :

- Dimensioning of the future process (nbre of washing machines?)
- Planning (nbre of operators on Monday?)
- Logistic study (best time arrival of the truck?)
- Cost study (cost of the chosen strategy?)

What it can do :

- Analyzing intra-hospital CSSD or external CSSD serving X hospitals
- strategic study (new operating room?, new customer hospital?,)
- tactical purposes (weekly planning, planning for vacations or for busy periods)

Production Planner in the Industry

What it could do:

- operational purposes (Business intelligence BI).
- interfacing with the programming tools used in the operating rooms theatre

~ Manufacturing Execution System (MES) in the Industry



Al for Hospital Sterilization







Al for Hospital Sterilization AR for Reconditioning



Process Improvment How to improve hospital sterilization process?

Sterilization must guarantee the quality of its process and control the sterilization cycle time to ensure high availability of nstrument sets Reconditioning stage

- Tedious and critical stage of the sterilization process
- Need to guarantee a high rate of compliance of the reconstituted sets
- The evolution towards a data matrix system for instruments -> improvement of the compliance rate but potentially (more) slow
- => There is therefore an interest in multiple detection to speed up this step by guaranteeing a good compliance rate.



Augmented Reality : Could this be useful at the reconditioning stage?



AI for Hospital Sterilization







AR for Reconditioning

AR Benefits :

- facilitate learning
- allow role versatility
- reduce the risk of human error
- ...
- reduce the space taken up by other interfaces, screen, keyboard, mouse, data matrix reader...

(DREAM for sterilization)

• Could allow multiple detection and auto-filling of the checking list





Assessment of AR solution for reconditioning

Results after discussion with specialists (AR, Vision, Sterilization)

- Current use for maintenance cases -> occasionally -> a few machines
- Case of sterilization -> continuous work -> a thousand sets of instruments

Points of attention

5

- → prolonged use of glasses by the operator (Assessment of acceptability by operators)
- → quantity of interaction (by wink for example)
- → quantity of instruments-> the examples involve a few pieces of equipment versus a thousand sets of instruments
- → recognition of instruments -> too much similarity between instruments
- → data matrix engraving potentially small (+ discussion on the engraving method)
- → lighting conditions for reading data matrices on metallic and reflective instruments

AR glasses still too futuristic for the taks



Al for Hospital Sterilization AR for Reconditioning





A more in-depth study was carried out for CARE NAM with the company Moviin and a derived prototype is currently being evaluated with initial positive feedback in terms of execution speed.



Al for Hospital Sterilization

mperature (°C)



Predictive Maintenance

- should be done by the equipment manufacturer -> « Servitization »
 -> advantage « Holistic view » of their products
- Although efforts can be pooled with Energy Efficiency
 - Detect energy "leakage"
 - Energy monitoring of tasks -> maintenance

Equipements:

- Washing Machine
- Autoclave
- Ultrasound
- HVAC



Wash Conductivit

Maintenance

Energy Efficiency





ROBOT



Automated Guided Hospital Carts (AGV) Savant Automation, Inc.



Al for Hospital Sterilization Robot, cobot,





Enhance your AGVs with advanced Routing

Automated Routing Demonstrator

AGV

- 15 nurses in car
- 200 patients
- Nurses start from hospital
- Patients are distributed all around (in a rectangle)
- Aim:
 - Minimize time spent on the roads
 - Visit all patients
 - Work = care + parking + journeys
 - limited working time per nurse
- Demonstrator:
 - No traffic jam management
 - Estimated visit Durations
 - No additional constraints

https://www.cetic.be/Demonstrations-of-Oscar-CBLS



AI for Hospital Sterilization Schedule



Operating room schedule optimizer with supply chain constraints (<u>CETIC projet SLS</u> Surgical Logistics System)





Conclusion



- The introduction of AI into the sterilization process must be part of a digital transformation approach
- Al is a toolbox and general-purpose technology that has the potential to augment the capabilities of the tasks to which it is applied
- We showed non-exhaustive examples of AI-driven improvements that can be applied to the hospital sterilization process.



Let's go for the

Sterilization of the Future!

Thank You!

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