trinity

REILUSTI ROBOTIIKKAA TEOLLISUUS X, 16.11.2021

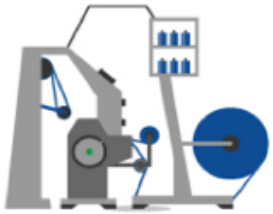
Professori Minna Lanz
Tampereen yliopisto

www.trinityrobotics.eu

The TRINITY project has received funding from the European Union's Horizon 2020 research and innovation programme under the GA 825196

Late 18th century | Beginning of 20th century | 1970s–2000s | 2010 onward

Teollisuuden vallankumoukset



First industrial revolution: Power generation

- Introduction of the power loom in 1784
- Mechanization of production facilities with water and steam power

Second industrial revolution: Industrialization

- Introduction of the assembly line in slaughterhouses in 1870
- Electrification drives mass production in a variety of industries

Third industrial revolution: Electronic automation

- Development of the first programmable logic controller (PLC) in 1969
- Growing application of electronics and IT to automate production processes

Fourth industrial revolution: Smart automation

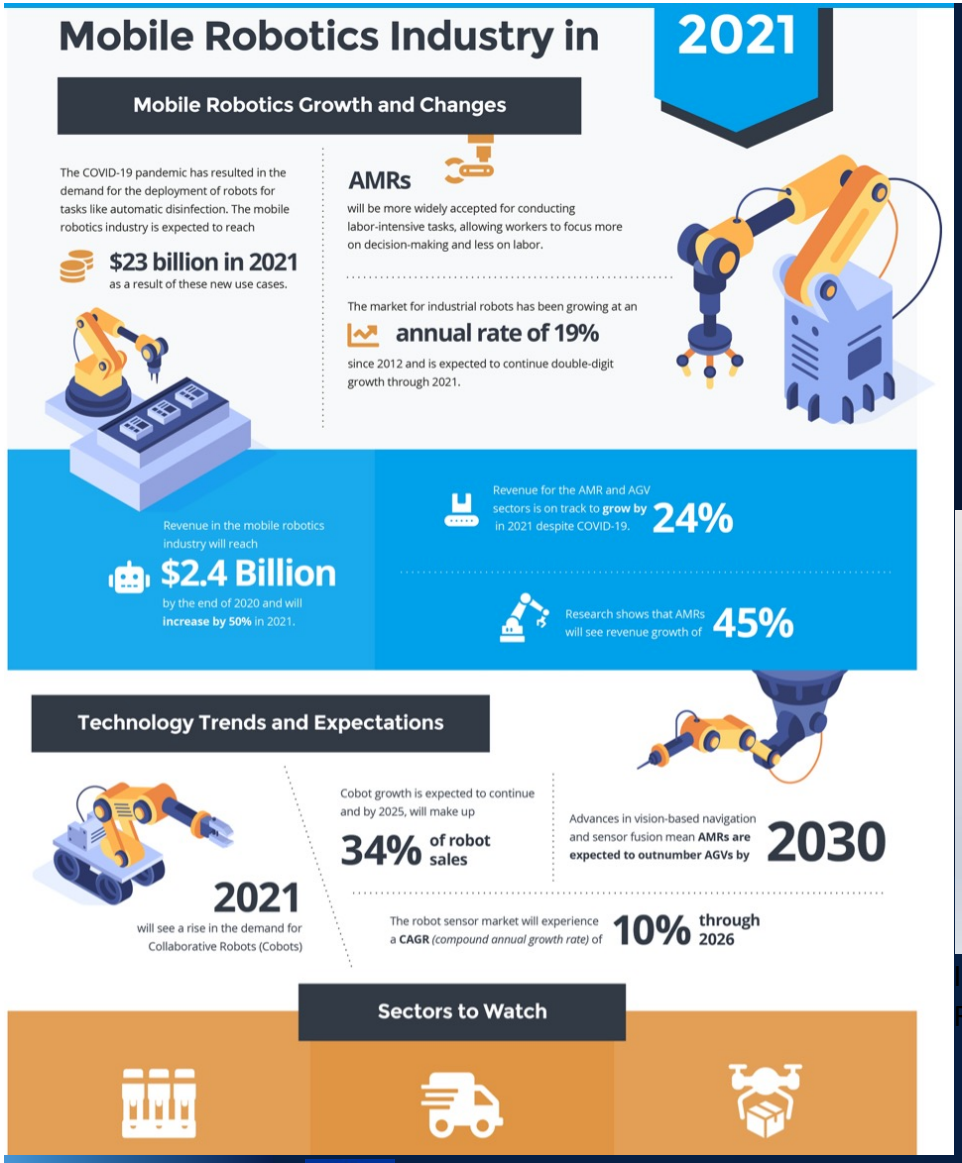
- Increasing use of cyber-physical systems (CPS)
- In January 2011, Industry 4.0 was initiated as a "Future Project" by the German federal government
- With the introduction of IPv6 in 2012, virtually unlimited addressing space becomes available
- Governments, private companies, and industry associations have been focusing on Industry 4.0 and making investments since the 2010s

Sources: Germany Trade & Invest, "INDUSTRIE 4.0—Smart manufacturing for the future," July 1, 2014; National Academy of Science and Engineering, "Securing the future of German manufacturing industry: Recommendations for implementing the strategic initiative Industry 4.0," April 2013; Deloitte analysis.

Teknologia-harppauksia:

Communication
Connectivity
Interfaces
Protocols
Sensors
Data collection
Platforms
Data sharing
Regulations
Human-centricity

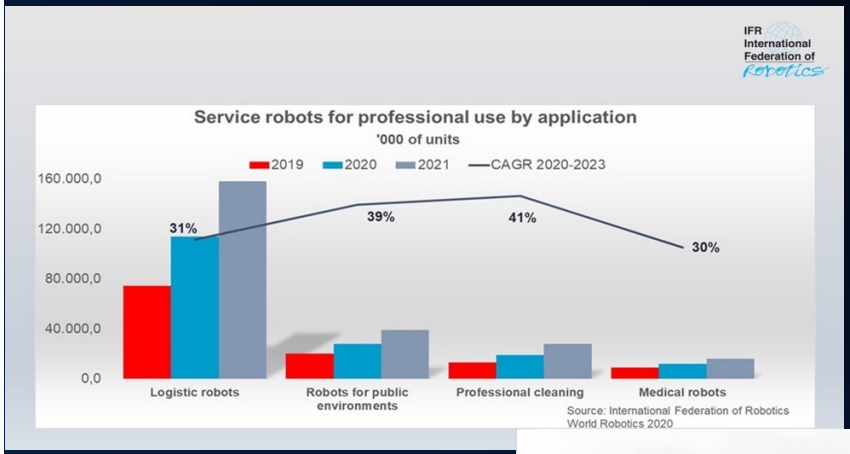
The THINKY project has received funding from the European Union's Horizon 2020 research and innovation programme under the GA 825196



Ref: https://hokuyo-usa.com/resources/blog/what-expect-mobile-robotics-industry-2021

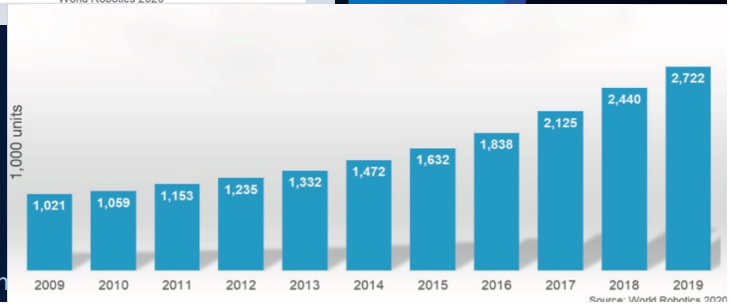
Key technology trends covered:

- Ecommerce retailers will embrace customer immersion technologies.
- Encryption/data privacy services will become mandatory—and profitable.
- Automation & robotics will infiltrate all stages of the supply chain.
- We've only just scratched the surface of virtual care.
- From Cobots & Beyond: Factory automation will boom.



IFR releases paper "A Mobile Revolution"

IFR: Operational stock of industrial robots – world



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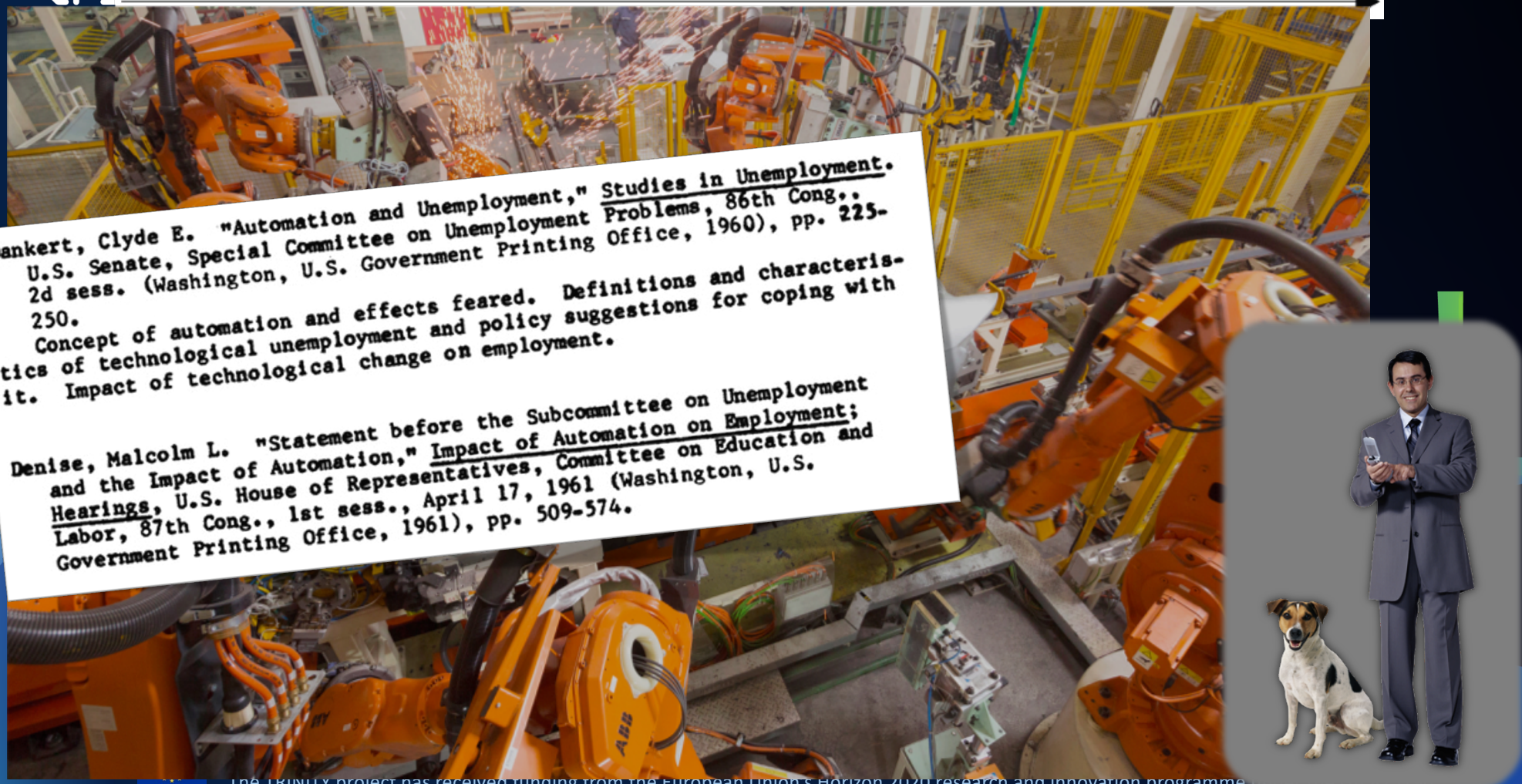


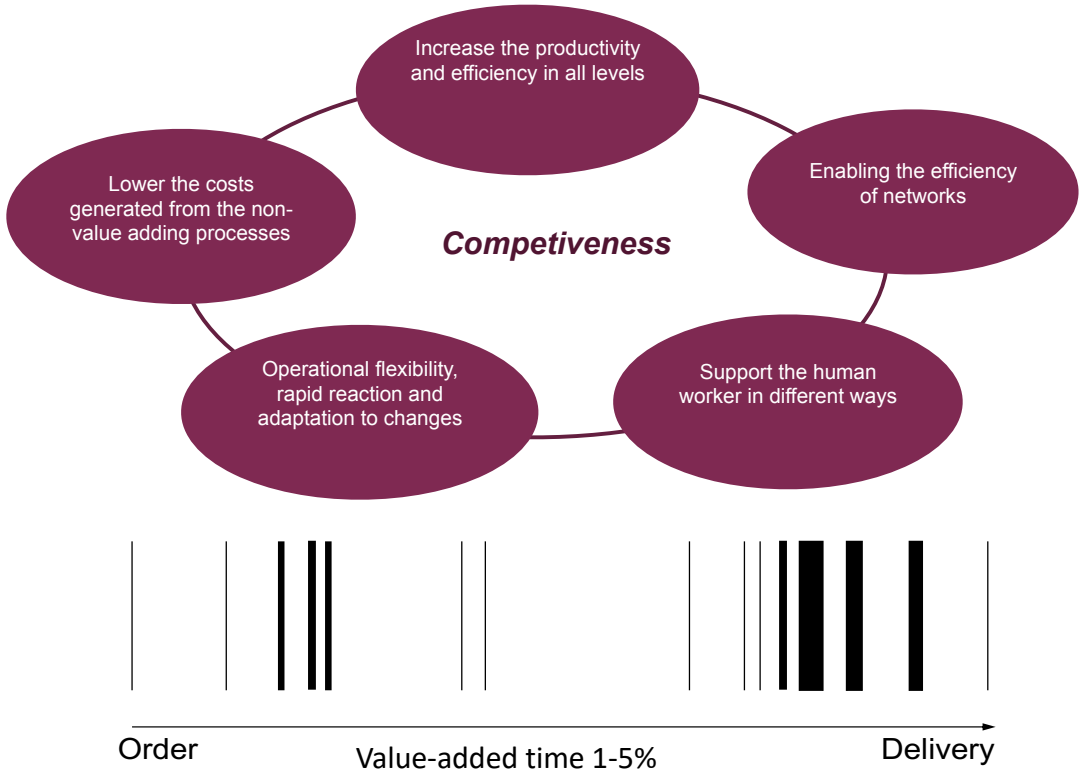
Dankert, Clyde E. "Automation and Unemployment," Studies in Unemployment. U.S. Senate, Special Committee on Unemployment Problems, 86th Cong., 2d sess. (Washington, U.S. Government Printing Office, 1960), pp. 225-250.

Concept of automation and effects feared. Definitions and characteristics of technological unemployment and policy suggestions for coping with it. Impact of technological change on employment.

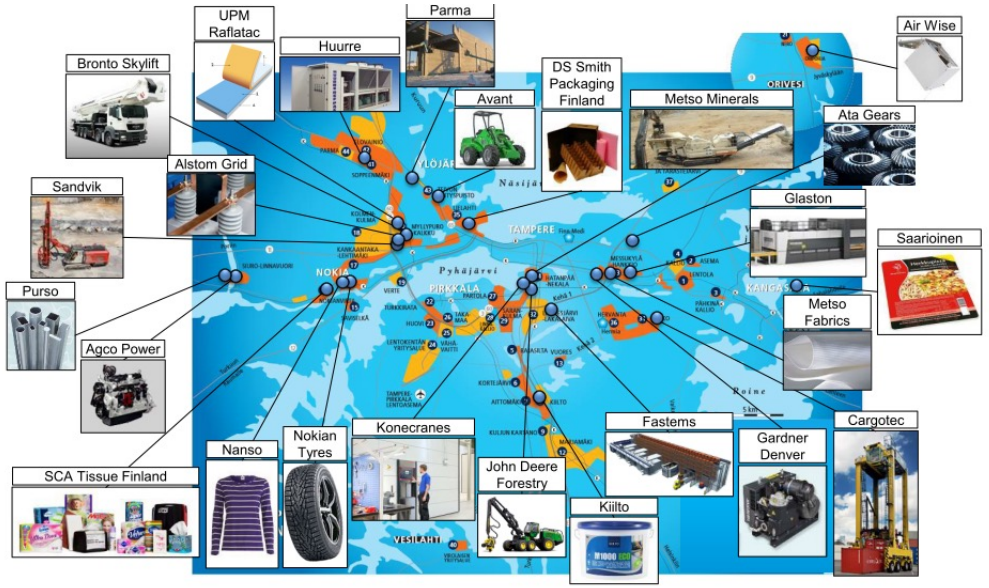
Denise, Malcolm L. "Statement before the Subcommittee on Unemployment and the Impact of Automation," Impact of Automation on Employment; Hearings, U.S. House of Representatives, Committee on Education and Labor, 87th Cong., 1st sess., April 17, 1961 (Washington, U.S. Government Printing Office, 1961), pp. 509-574.

The TRINITY project has received funding from the European Union's Horizon 2020 research and innovation programme under the GA [illegible]

Reunaehdot teknologian kehitykselle



Teollisuus4.0: Yhden kappaleen eräkoko taloudellisesti kannattavaksi!



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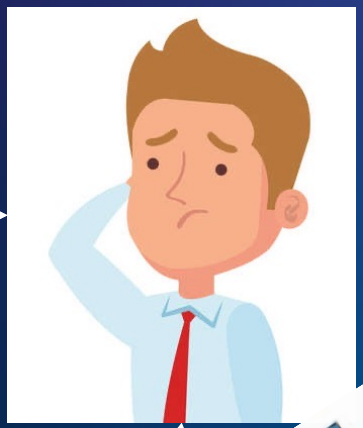
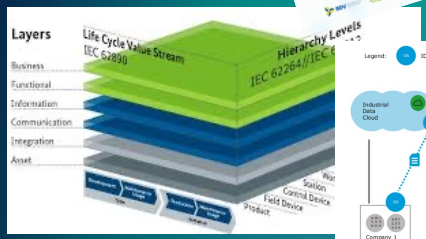
Pari pientä lisähaastetta

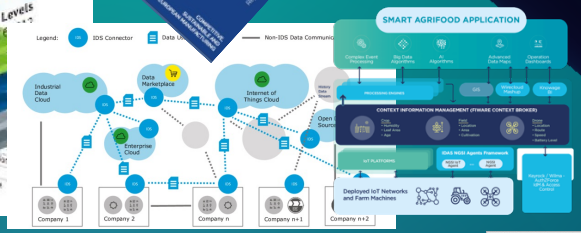
Toimiikohan se?
Osataankohan me?

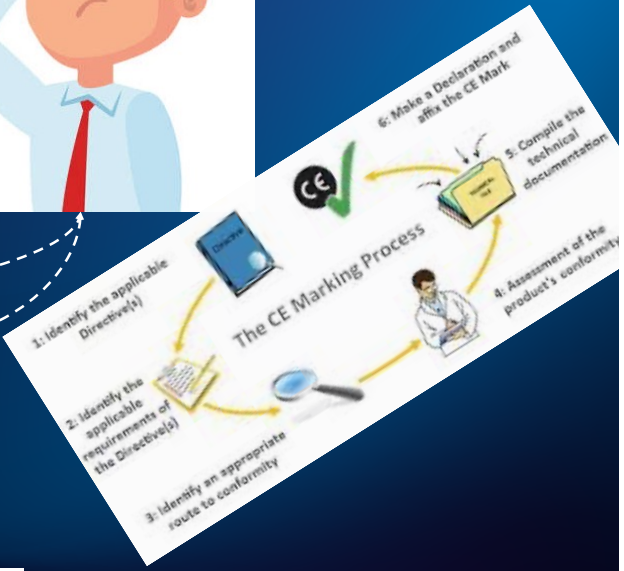
Hienoja visioita



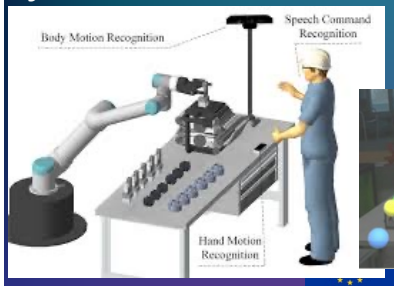
Uusia alustoja

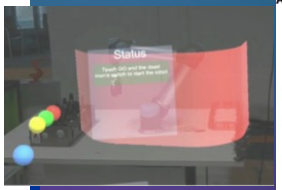


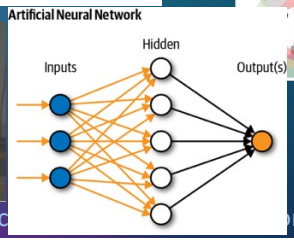


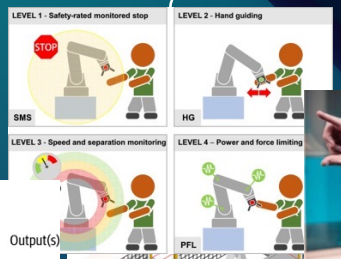


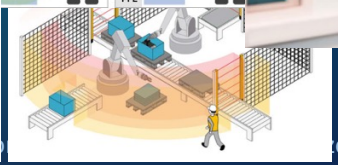
Teknologiaa oikealta ja vasemmalta











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Hypoteesi robotisoinnille, digitalisoinnille ja yhteistyölle

Increase the product quality and production capacity by robotics

- Mundane tasks for robots (e.g. dirty, dull and dangerous tasks)
- Transform (human) operator to knowledge worker and problem solver (e.g. system supervisor)
- Ensure that the factories can operate with less engineers (since we will lack those)

Shorten the overall production time with ICT and AI

- Increase supply network transparency
- Realise reliable real-time data collection
- Predict and prepare for continuous changes

Benefit from industrial ecosystems (e.g. DIHs)

- Share resources, capacity and expertise
- Answer together to the changing customer needs
- Support the life-long learning and digital capability building

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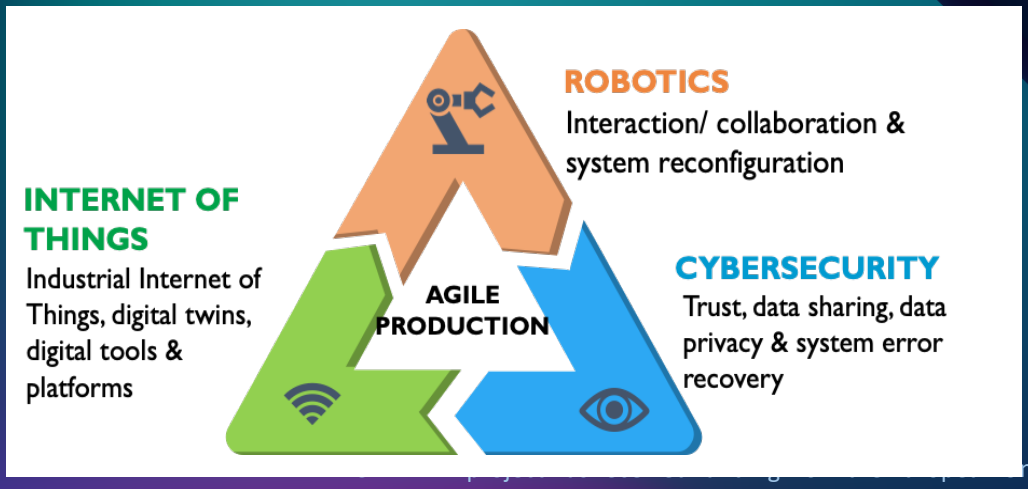
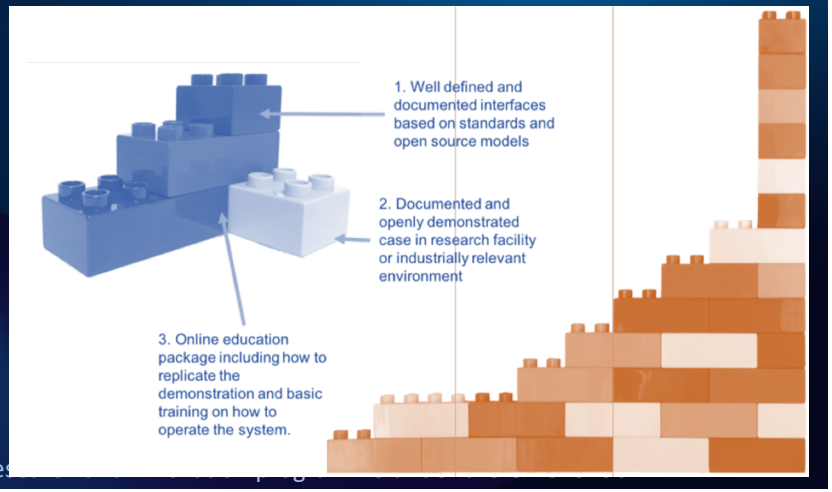
H2020 TRINITY 2019-2023

The main objective of TRINITY is to **create a network of digital innovation hubs (DIHs)** composed of Research Centres and University Groups specialized in Advanced Robotics and Internet of Things (IoT), supported by a DIH with experts in Robotics Cyber security to contribute to novel robotics solutions that will increase agility in production.

The second objective is to continue this network after the ramp-up phase, by building a **sustainable business model** throughout the project lifetime.

The third objective is to deliver a **critical mass of use case demonstrations** in collaboration with industry to support the industrial modernization leading to more agile production and increase the competitiveness of European companies.





nion's Horizon 2020 re

Demonstraatioiden sijoittuminen teemoihin

* koostuvat erillisestä 32 teknologiamoduulista

#	Use Case Demonstrator	Rob.	IIoT	CS
1	Vision-based safety in collaborative assembly	■		
8	Efficient robot programming by demonstration	■		
11	Robotized serving of automated warehouse	■		
13	Mobile robots in collaborative work cells	■		
2	AR interaction in collaborative disassembly	■	■	
3	Collaborative robotics in larger scales	■	■	
4	AR/VR-based enhancement of the digital twin	■	■	
5	Wire arc additive manufacturing with robots	■	■	
7	Robot workcell reconfiguration	■	■	
10	HRI framework for operator support	■	■	
12	User-friendly programming of HRC tasks	■	■	
17	AI-based object pick-up by a robotic arm	■	■	
6	Production flow simulation/supervision		■	
9	Dynamic task planning & work re-organization		■	
14	Robot cell virtualization		■	■
15	IIoT Robustness Simulation		■	■
16	Flexible automation for agile production		■	■
18	Rapid development of large scale WSNs		■	■

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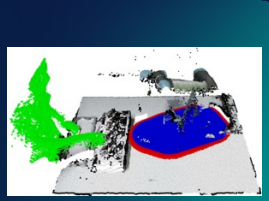
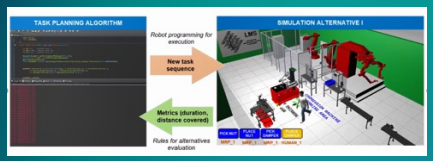
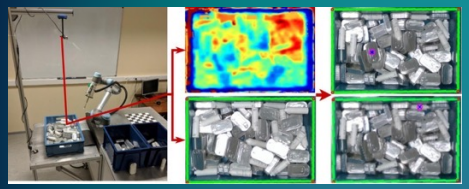
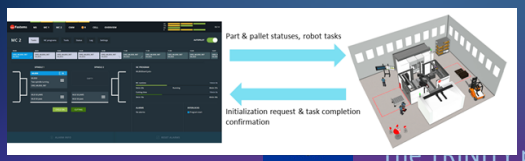
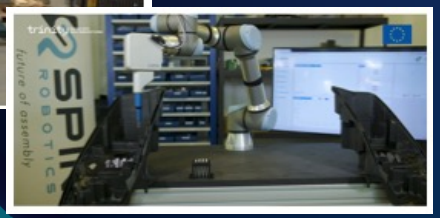
H2020 TRINITY 2019-2023

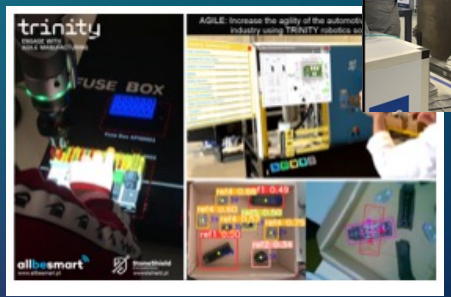
From Internal demonstrations → To Demonstration Program 1 Results → And to communication to the wider robotics developers and users

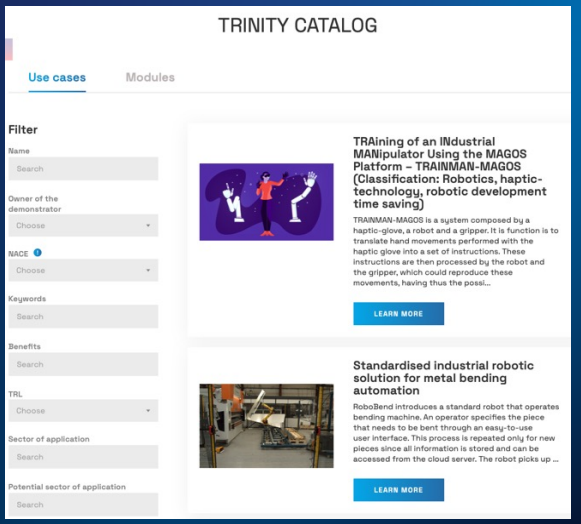




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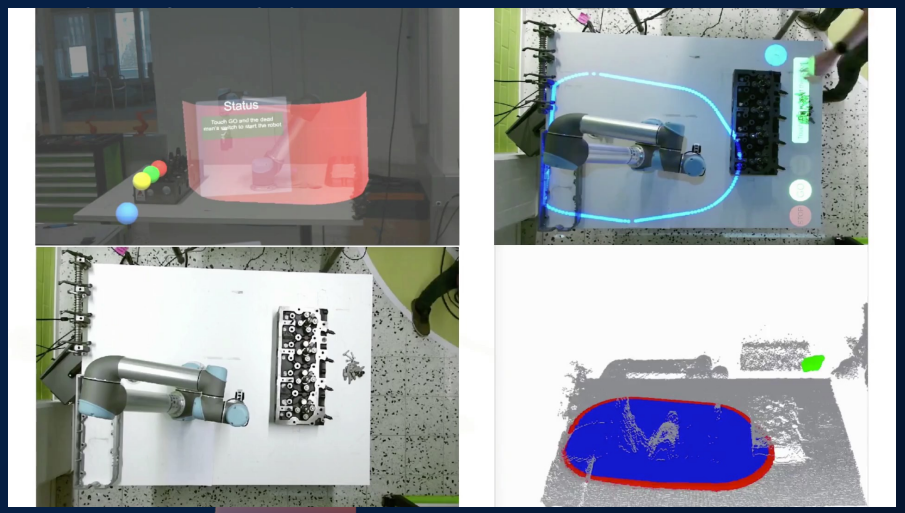
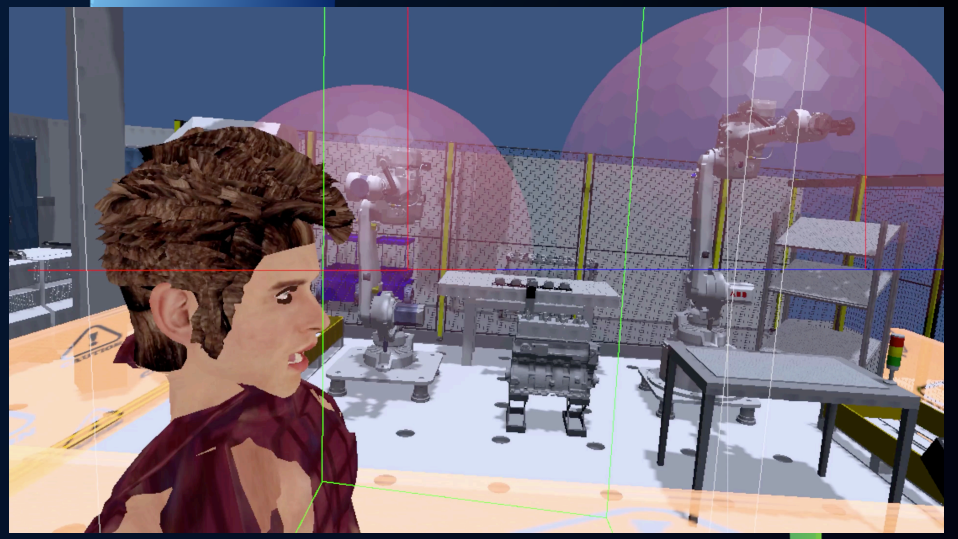
Uusia käyttöliittymiä ihmisen ja koneen väliseen yhteistyöhön



Työturvallisuuden kouluttaminen VR:n avulla



Digitaalisten kaksosten hyödyntäminen robotiikassa

https://youtu.be/qoQ2jFiy51g

Viestiminen valoilla ihmiselle

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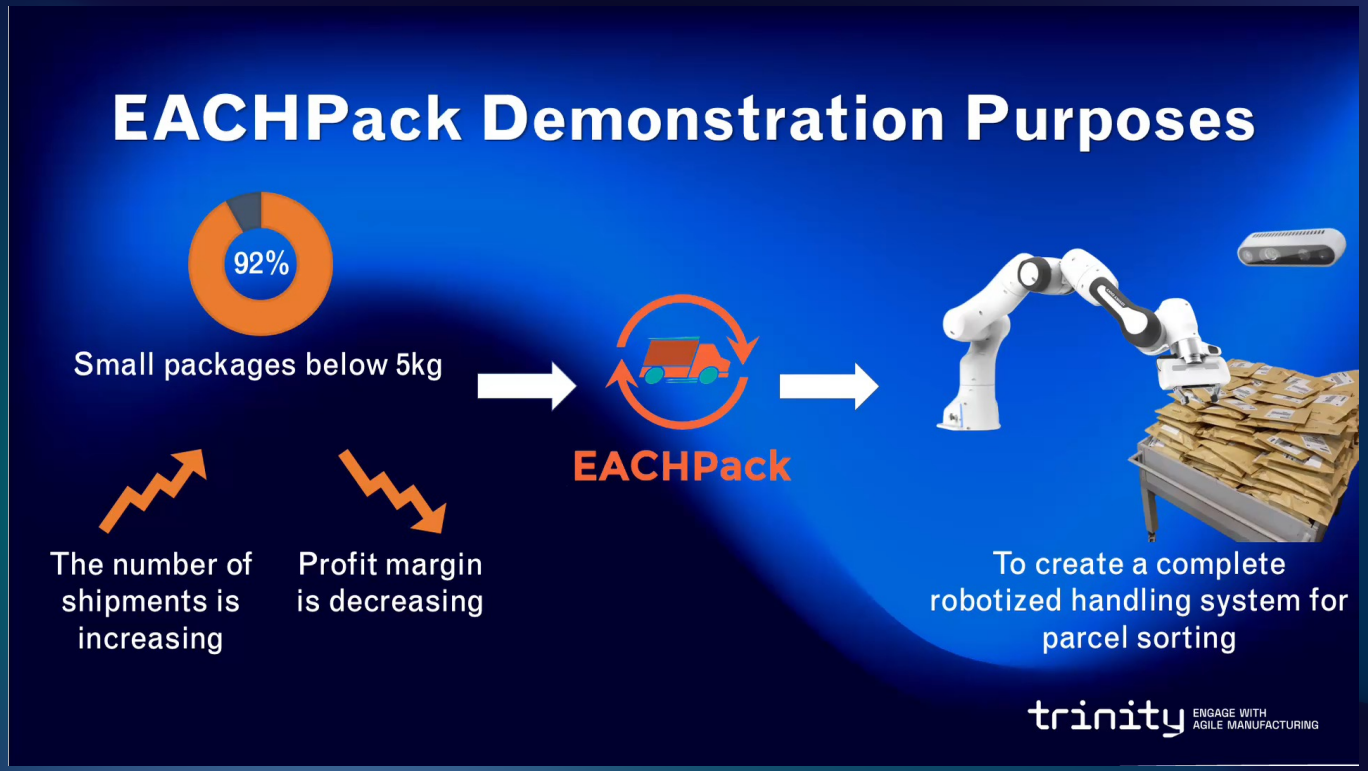
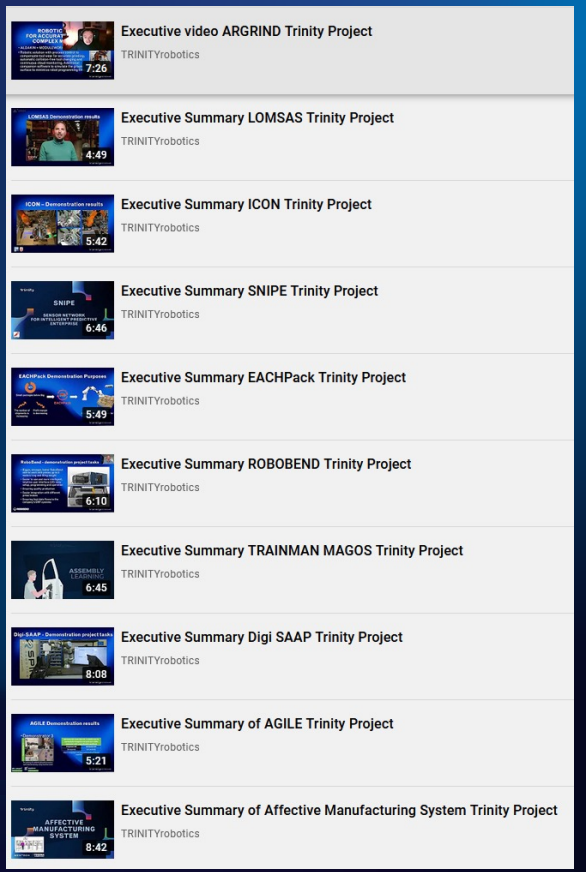
TRINITY Demonstration Program 1, results in YouTube





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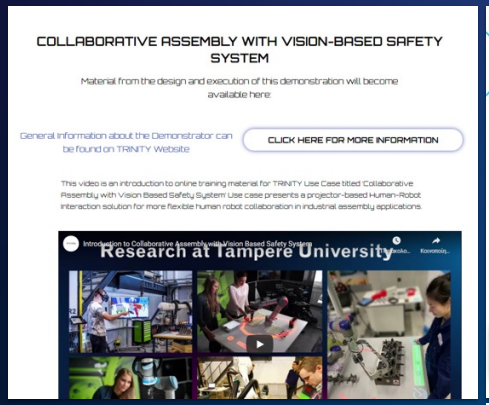
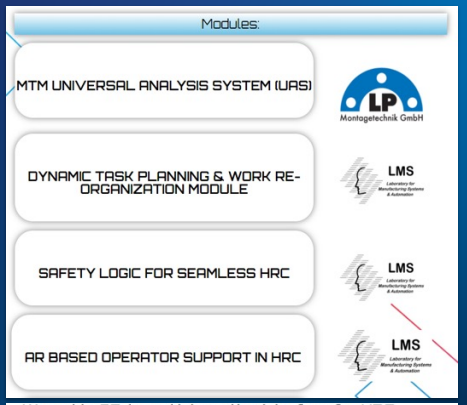
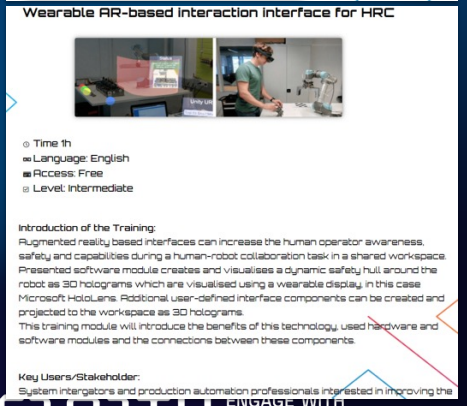
TRINITY Training Platform

- Ilmaisia opetusmateriaaleja TRINITY Moduuleista and Use Case:sta
- Paljon muuta tietoa joustavan ja robotisoidun valmistuksen teknologioista
- Videomateriaalia tarjolla, ja lisää tulossa

https://trinity-trainingplatform.eu/







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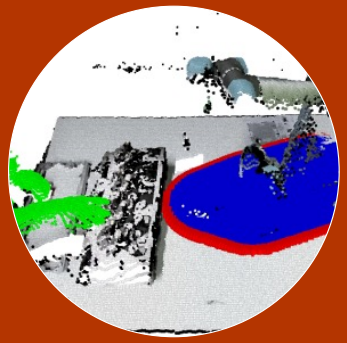
Intuitive and multi-modal programming environment: workers do not need prior in-depth knowledge of the system,

Zero-programming: ideally, the workers can work with the robots via gestures, voice commands, and other forms of natural input without the need of coding

Immersive collaboration: with the help of different devices, e.g. screens, goggles, wearable displays, the worker scan collaborate with the robots with actively engaged senses



Context/situation dependency: the system should be capable of interleaving autonomous human with robot decisions based on trustworthy inputs from on-site sensors and monitors inspecting both humans and robots.

Tulevaisuuden kehityssuuntia robotiikassa 2025-2030

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Thank you!

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