



Designing industrial cobotic systems through a participative approach

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INTRODUCTION

« Cobotics » in industry:

- PhD in cognitive engineering
- With a roboticist
- Aim: A methodological approach for cobotic systems



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1 Cobotics





Robot: reprogrammable manipulator used in industrial automation processes.



Cobot: robot designed with sufficient security devices to work with humans in a shared workspace.

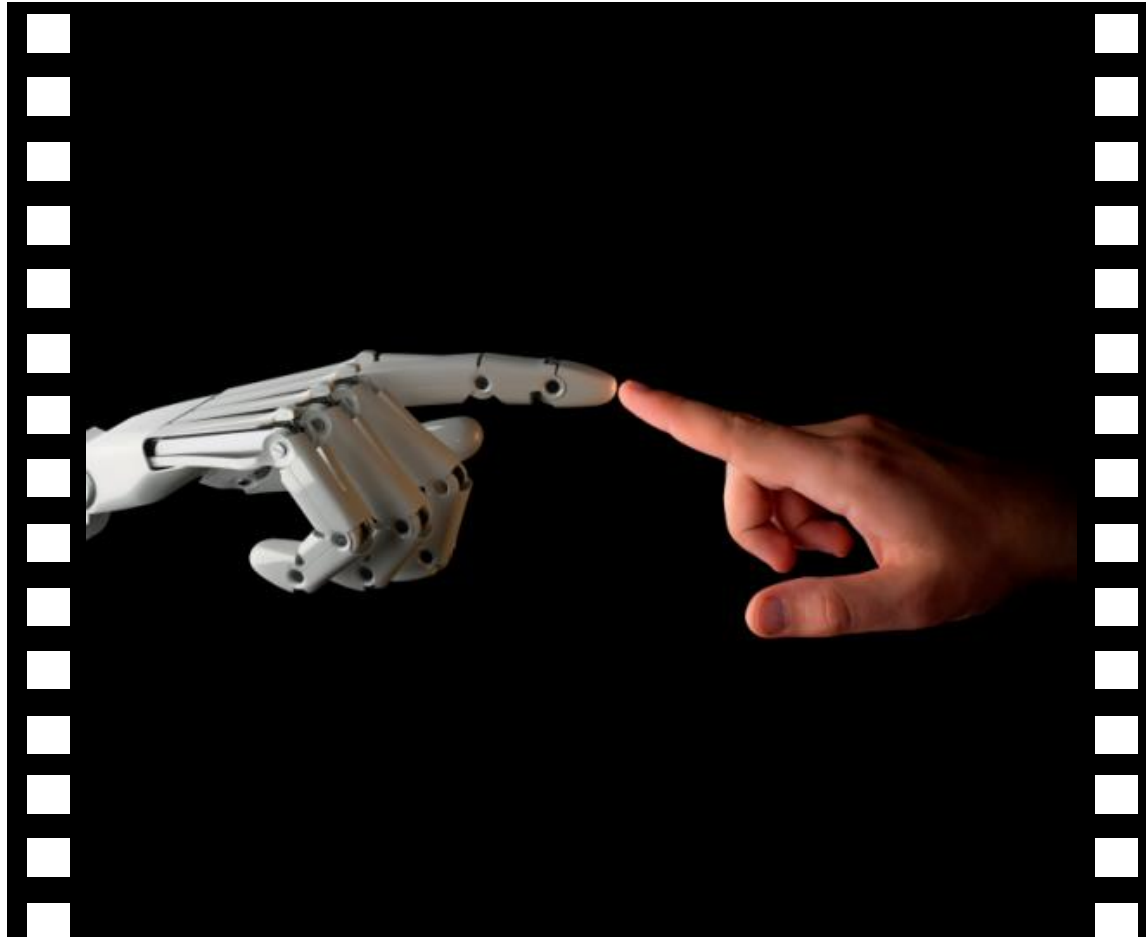


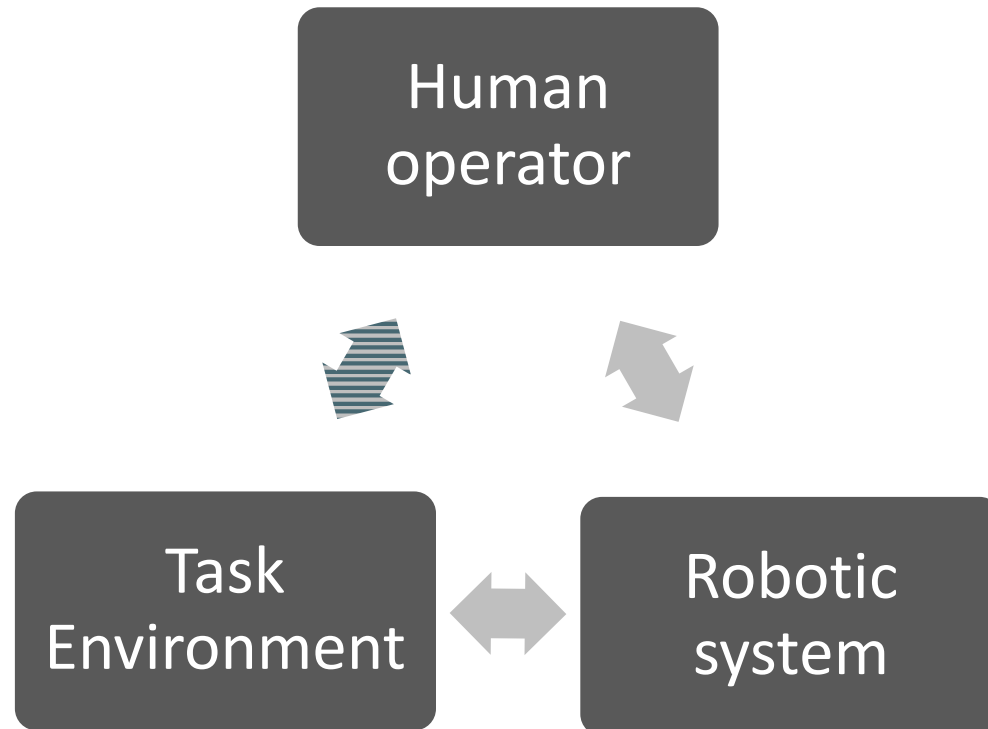
Cobotics: human robot interaction to perform a task.



Cobotics is compatible with the use of classical robots !







Moulières-Seban T., Bitonneau D., Thibault JF., Salotti JM., Claverie B., « Human Factors Issues for the Design of a Cobotic System » AHFE 2016, Orlando, E.-U., juillet 2016

1 / Cobotics – Shared workspace



1 / Cobotics – Comanipulation



1 / Cobotics – Remote interactions



1 / Cobotics – Exoskeletons





2 Participative design and Cobotics





Project team creation:

- ✓ Operators
- ✓ Foreman
- ✓ Industrialization
- ✓ Maintenance officer
- ✓ Decision maker
- ✓ Process and method expert
- ✓ Other





1 Preliminary analysis

2 Theoretical solution

3 Basic design

4 Advanced design

5 Industrialization



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Activity analysis



Interview

Observations

Debriefing

Real operations



Formalization



1 Preliminary analysis

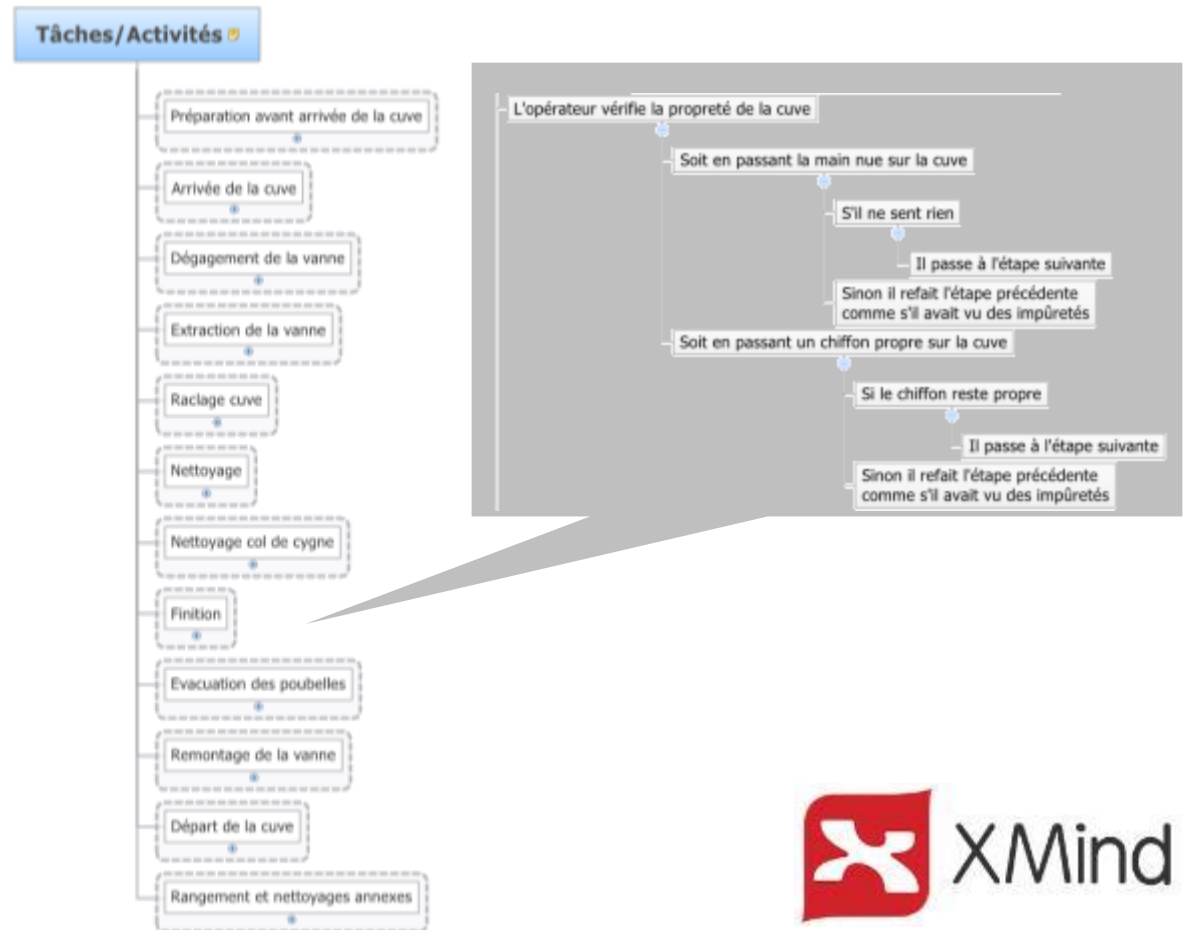
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Activity analysis: formalization in diagrams





1 Preliminary analysis

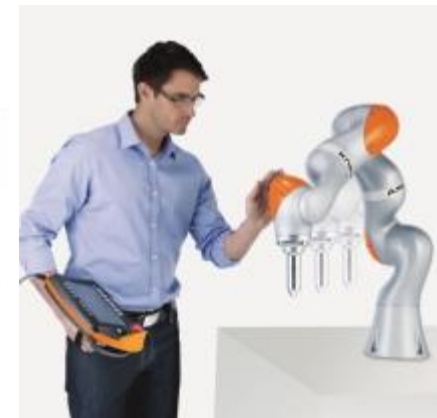
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Technology review





1 Preliminary analysis

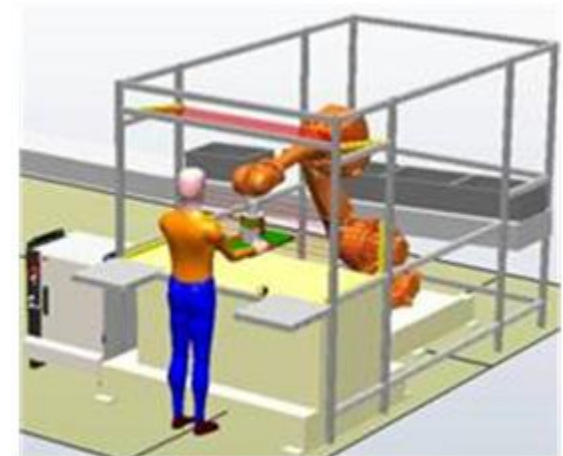
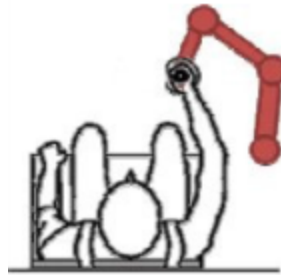
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Theoretical solution





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Simulation-based approach with the future users



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Simulation-based approach with the future users



Future activity scenario



Based on previous analysis

Operator and robot task/role allocation



1 Preliminary analysis

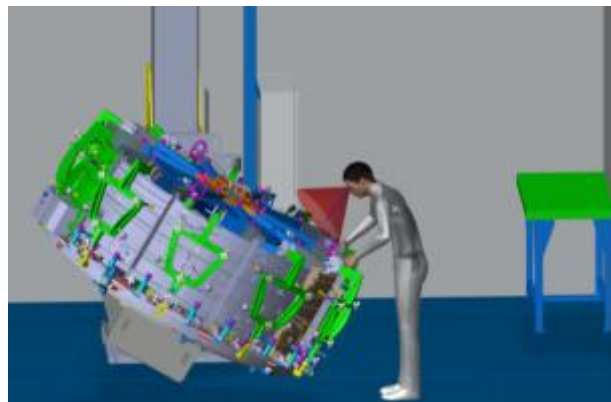
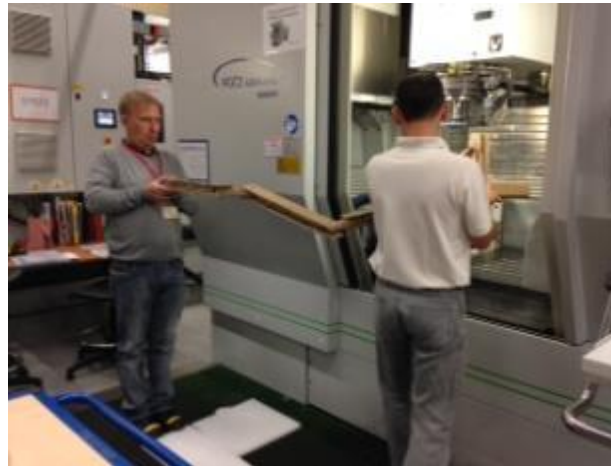
2 Theoretical solution

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4 Advanced design

5 Industrialization

Simulation mediums





1 Preliminary analysis

- *Technical specifications*

2 Theoretical solution

- *Investment*

3 Basic design

- *Realization*

4 Advanced design

- *Setting up*

5 Industrialization

- *Teaching*

- *Certification*

- *Putting into service*

- *Lessons learned*



3 Use case: Tank cleaning



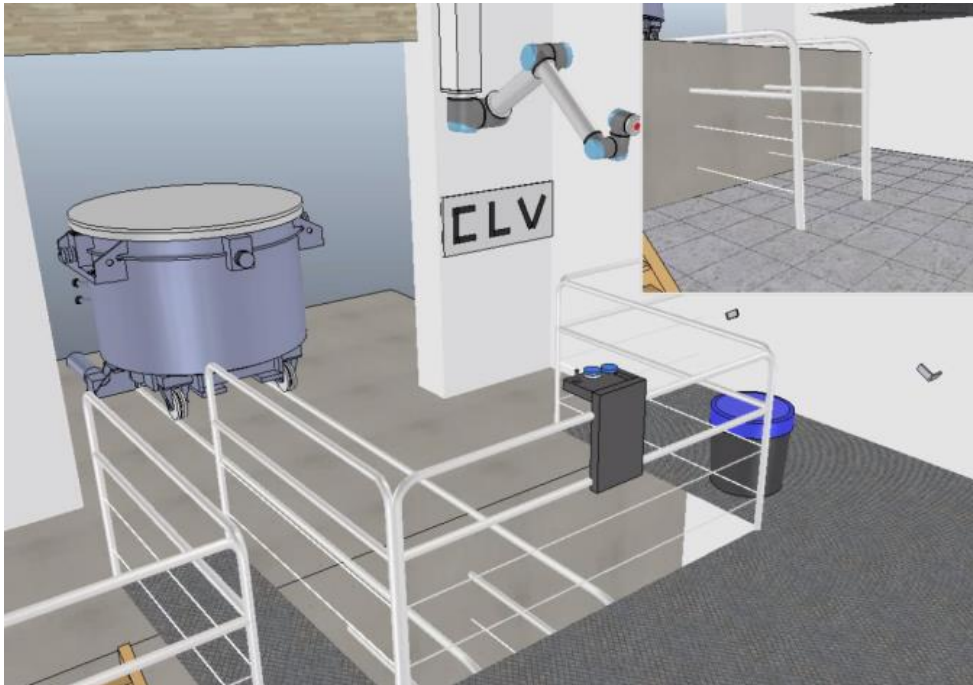
3 / Use case: Tank cleaning – Activity analysis



3 / Use case: Tank cleaning – Theoretical solution



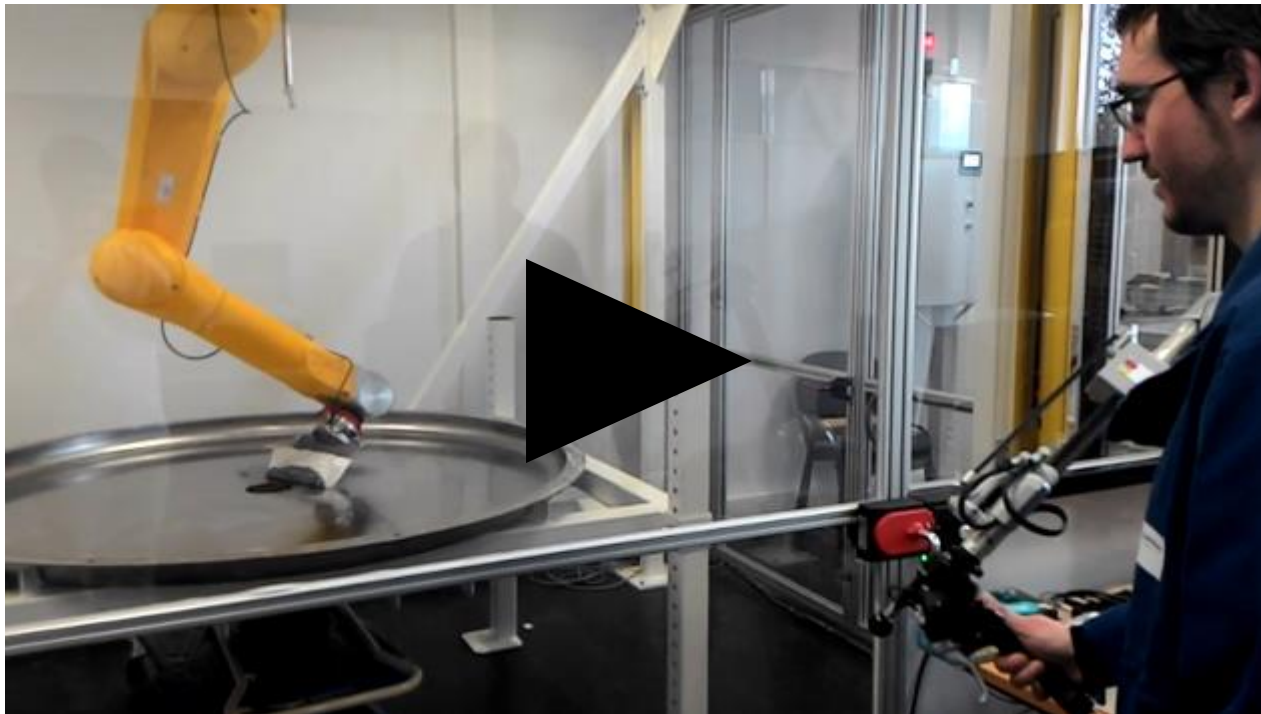
Tank cleaning **theoretical solution** and **interactive mockup**:



3 / Use case: Tank cleaning – Prototype



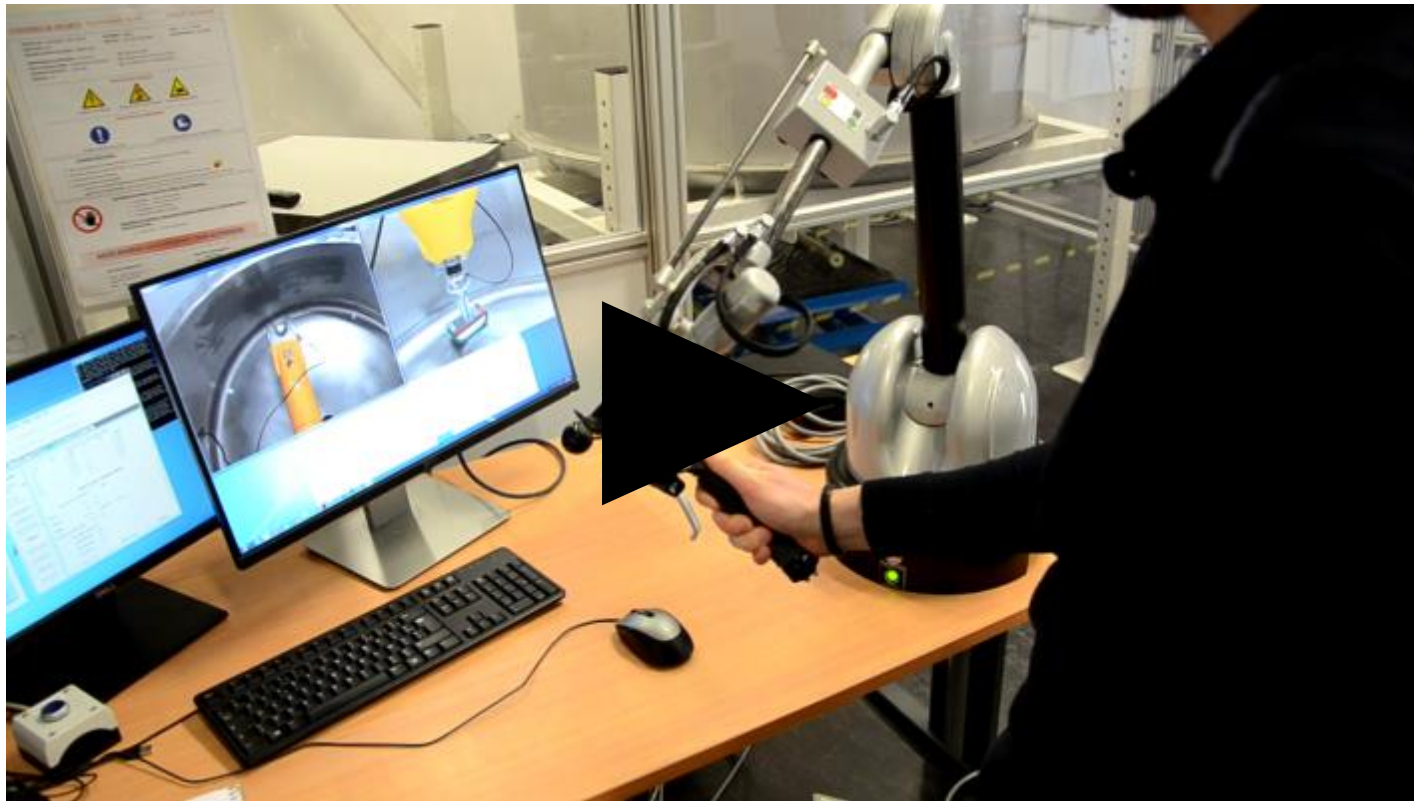
Teleoperation with a haptic device (direct vision):



3 / Use case: Tank cleaning – Prototype



Teleoperation with a haptic device (indirect vision):



3 / Use case: Tank cleaning – Prototype



Teleoperation with a joystick:





Next steps:

- Scale 1 simulation in Virtual Reality



- Technical specifications
- Investment decision

CONCLUSION

Methodology:

- Including safety and normative aspects
- To be completed (industrialization steps in progress)
- Operators were involved and creative



Cobotics and participative design:

- Starting with activity analysis
- Through simulations



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