Transforming Offshore Operations with Aerial Robotics

Enabling Green Energy Transition

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OFF-SHORE WIND ENERGY

2023: 4.5 GW

Plan

2030: 21 GW

2050: 38-72 GW

350%

750%

BirdStrike

Delamination on the leading edge

cleaning

Laminating

Roller-painting

Grinding

- **Safety**
- **Speed**
- **Cost-effectiveness**
- **Long life**
- **Less downtime**
- **Limited experienced workers**

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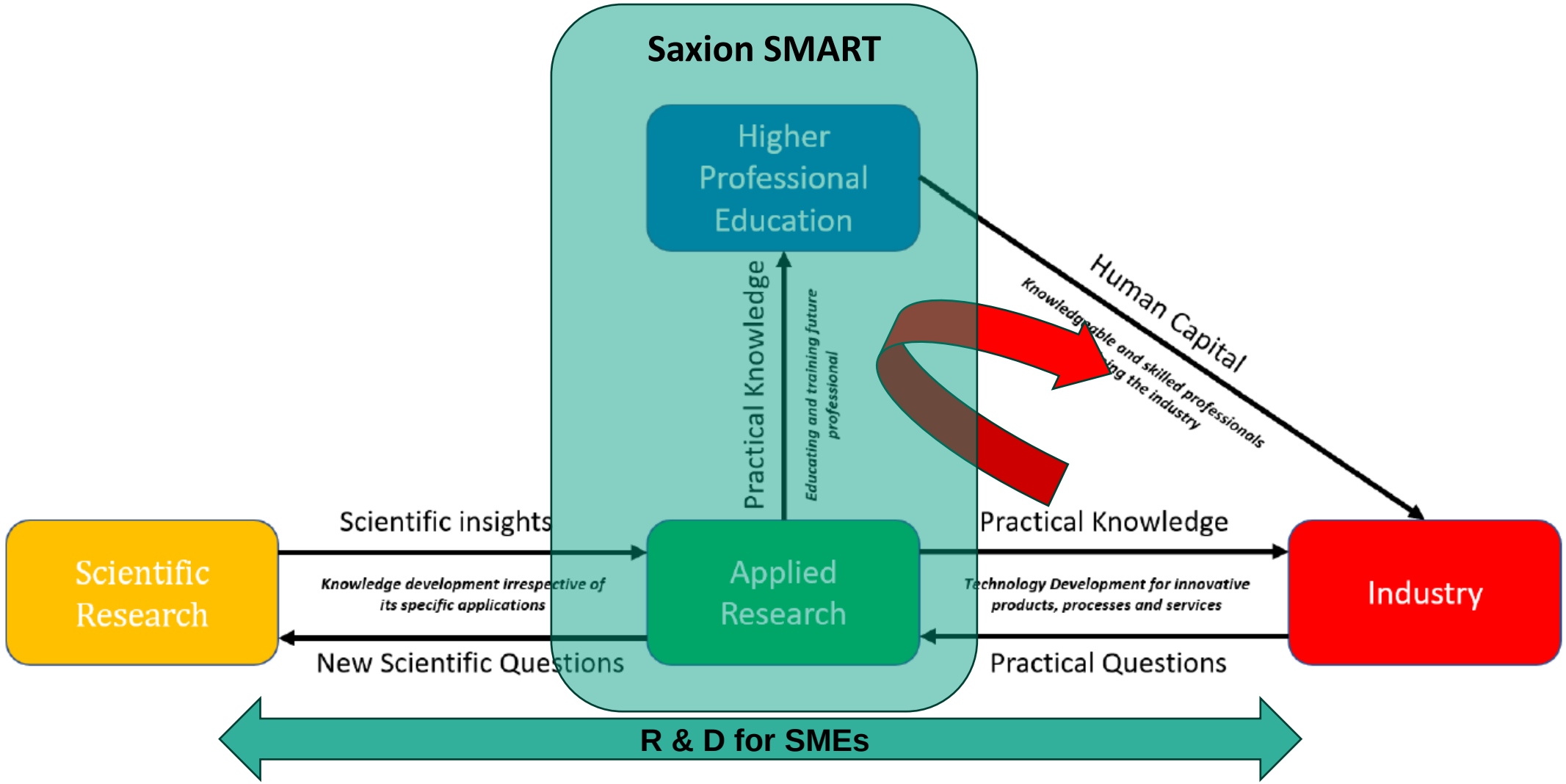
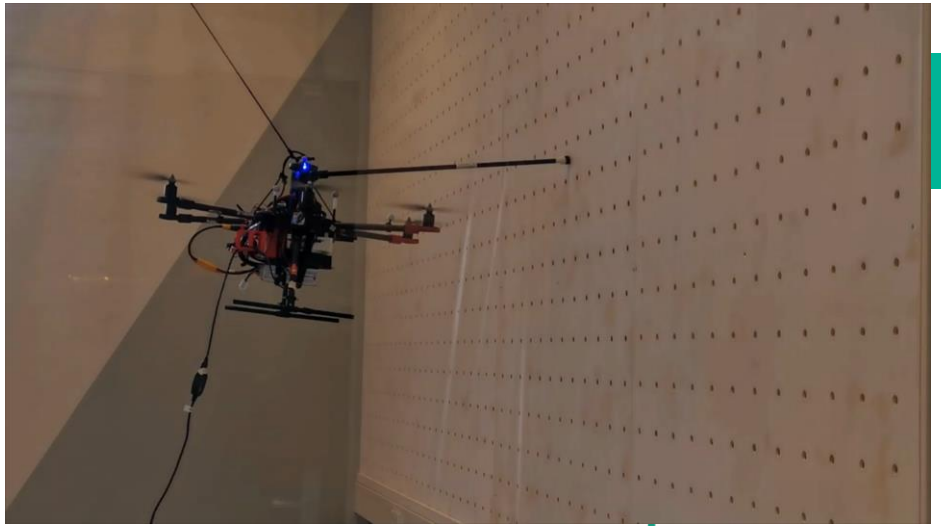
Applied Research: Demand-Driven



Aerial Physical Interaction: Flying Hand

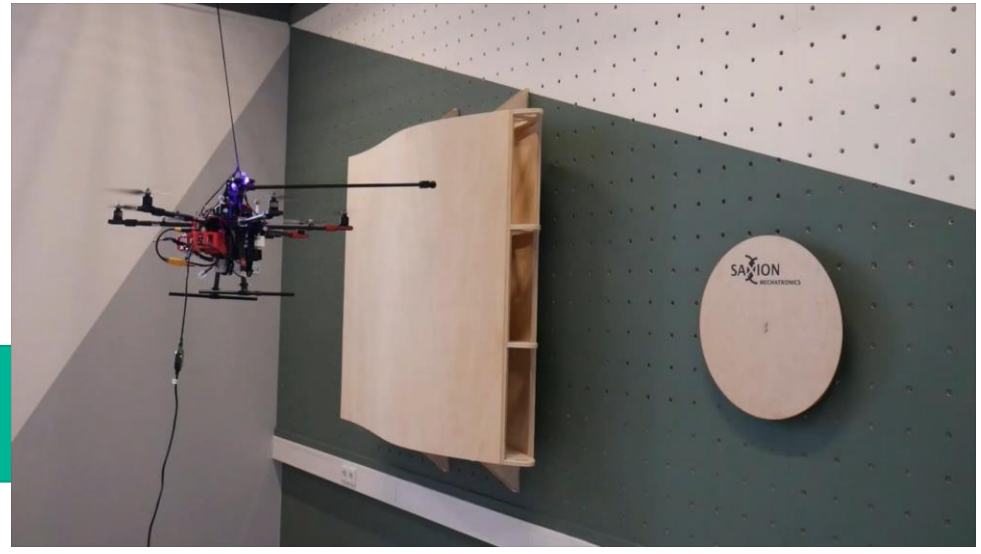
Intermittent unexpected interaction

Significant disturbance and recovery



Interaction of flat surface

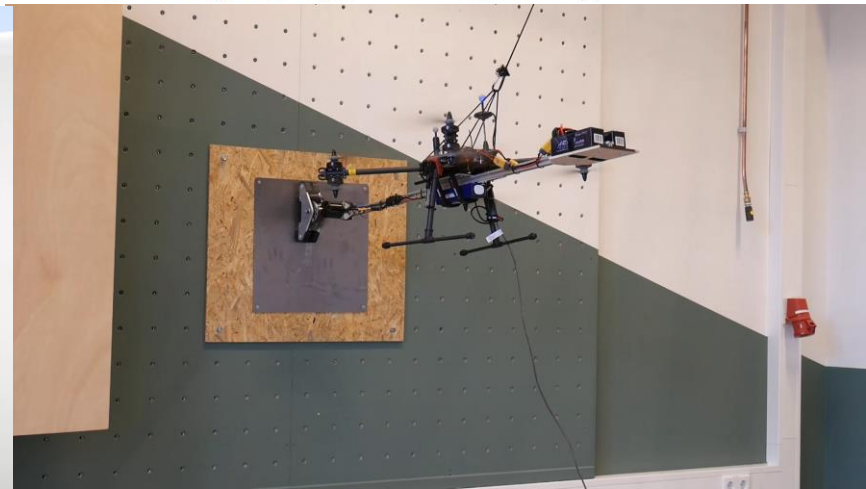
Interaction on non-flat surface



Physical Inspection and Maintenance with Aerial Robots

- Modularity (software and Hardware)
- Maintainability
- Reconfigurability
- Generality

cleaning Laminating Roller-painting Grinding



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Open-Source Design

Sarax: An Open-Source Software/Hardware Framework for Aerial Manipulators

Ayham Alharbat[1,2], Dion Zwakenberg[1], Hanieh Esmaeeli[1,2], and Abeje Mersha[1]

Abstract— The use of Multi-Rotor Aerial Vehicles (MRAVs) in tasks that require physical interaction has been an active research field in the last decade which resulted in an increasing interest in Aerial Manipulators (AMs). This raises many challenges in the modeling, control, perception, and planning of these robots. However, designing and realizing an AM testbed is a complicated multi-disciplinary task, and there is a lack of standardization in the relatively new field of AMs. For this purpose, we introduce Sarax, an open-source hardware and software framework tailored for AMs research and innovation. The software of Sarax is built on top of open-source projects such as the Robot Operating System (ROS) and PX4 Autopilot, while the hardware is designed to be customizable, modular, and easily scalable through parameterized models. We verified and validated the proposed framework through indoor and outdoor experiments. We aim to open the door to accelerate AMs research and innovation, allow researchers and developers to focus on their core contributions, and take AMs technology to a higher readiness level.

Fig. 1: Snapshot of Sarax, the proposed Aerial Manipulator platform, during a physical interaction task.

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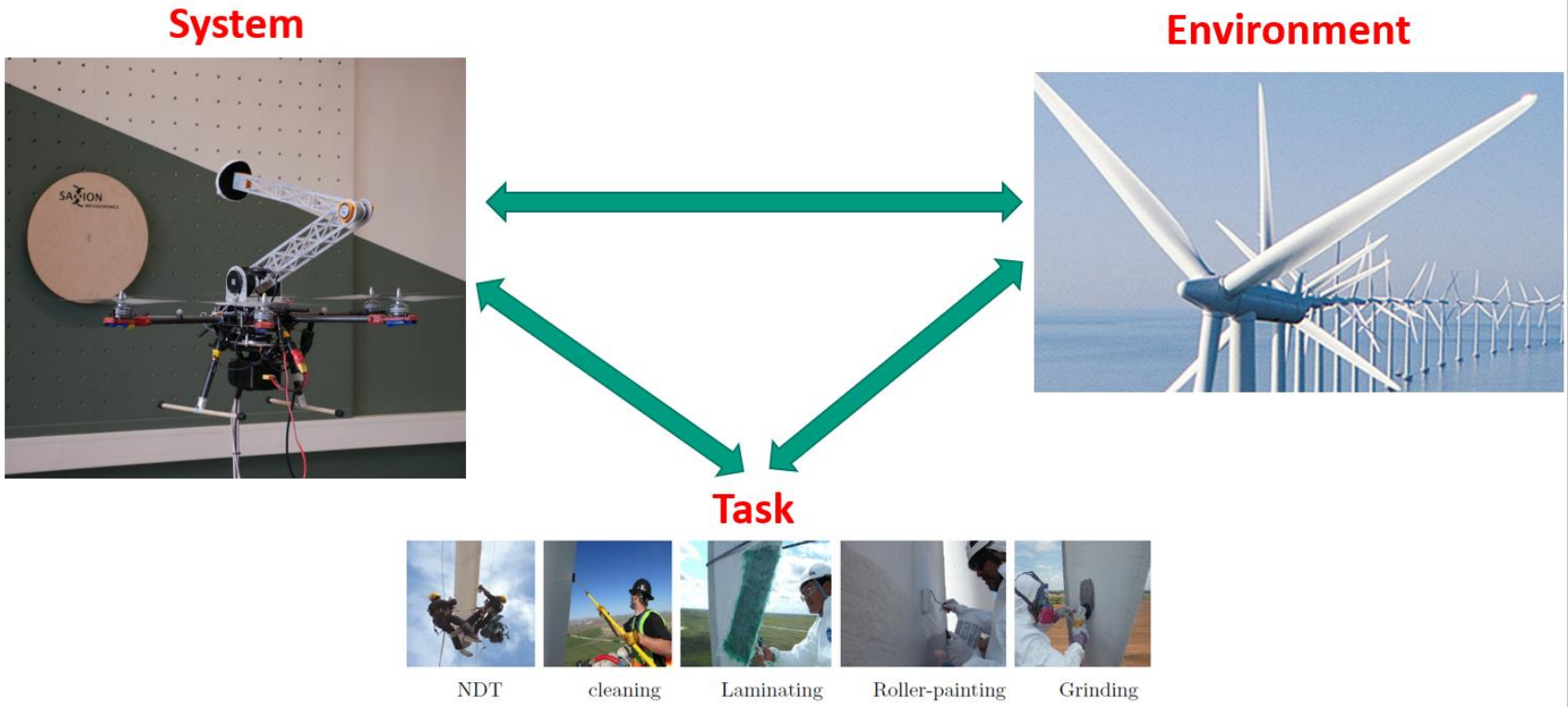
REDACTED

Conclusion

- Robots are not only useful, but also indispensable in ensuring energy transition
- Applied research is the master key in
  - Bridging the gap between fundamental research and industry
  - Making state-of-the-art practical knowledge accessible
  - Providing systematic and holistic approach



Thank you!

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