

NRI:FND: Collaborative Mobile Manufacturing in Uncertain Scenarios

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<https://nri-cmmus-lsu.github.io/dist/index.html>

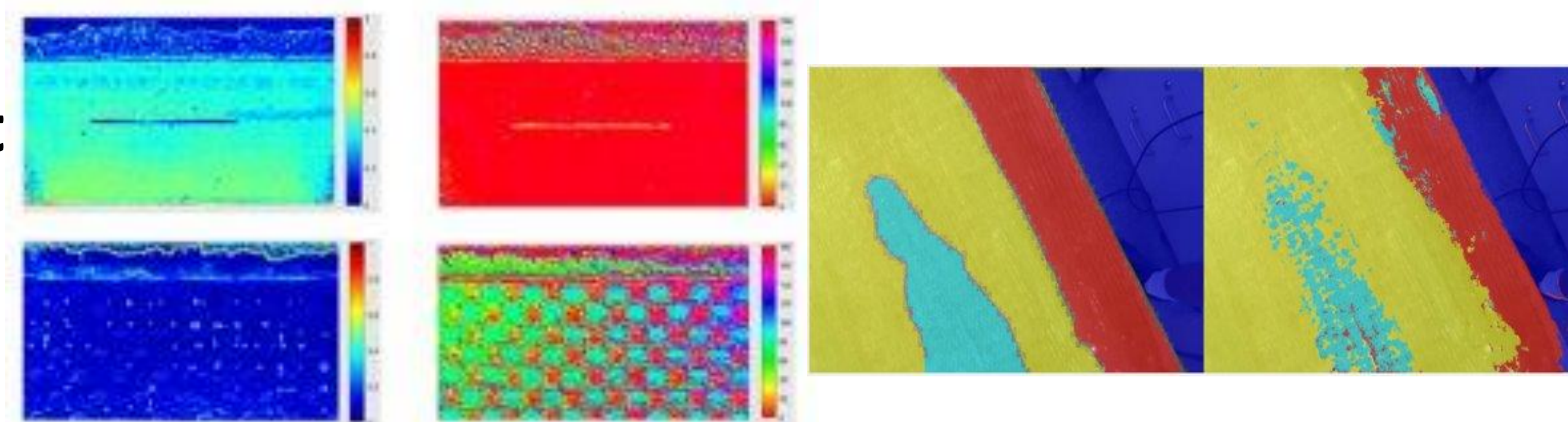
Overview: This project develops a scalable, mobile, co-robotic system that leverages robot-robot collaboration with trained human supervisors for large-scale manufacturing applications, focusing on finishing operations for composite wind turbine blades.

Key challenges: Specific barriers hinder the automation of finishing processes: **1)** final part shape differs from the planned geometry, **2)** nature and duration of the task vary from one part to the next, and **3)** task completion is based on human judgment and experience.

Research and Scientific Impact

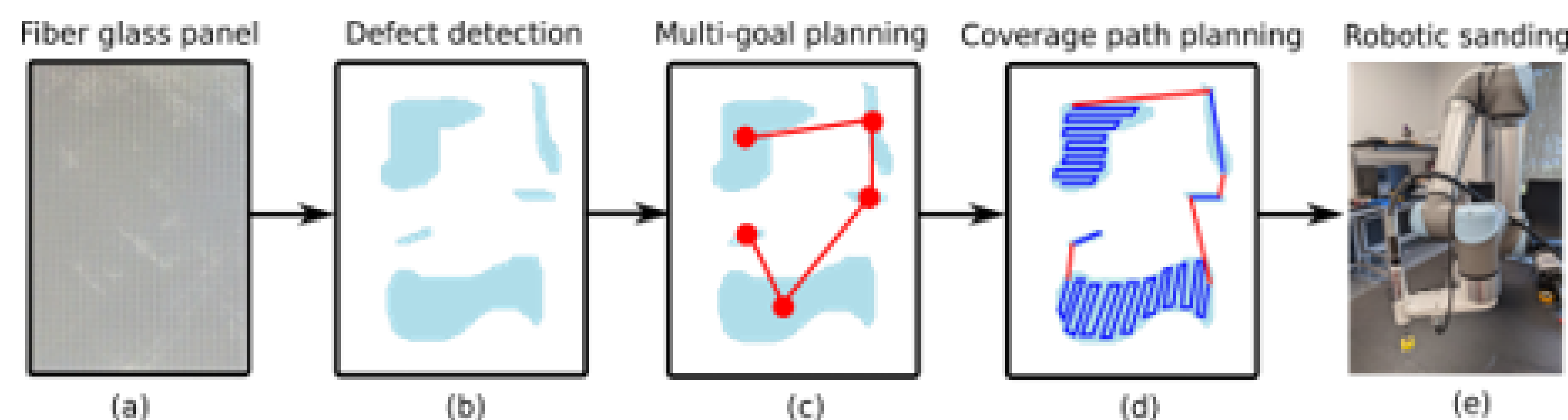
1. Perception systems for quality assessment

- Identification and classification of defects
- Use of polarized computational imaging
- Machine learning approaches



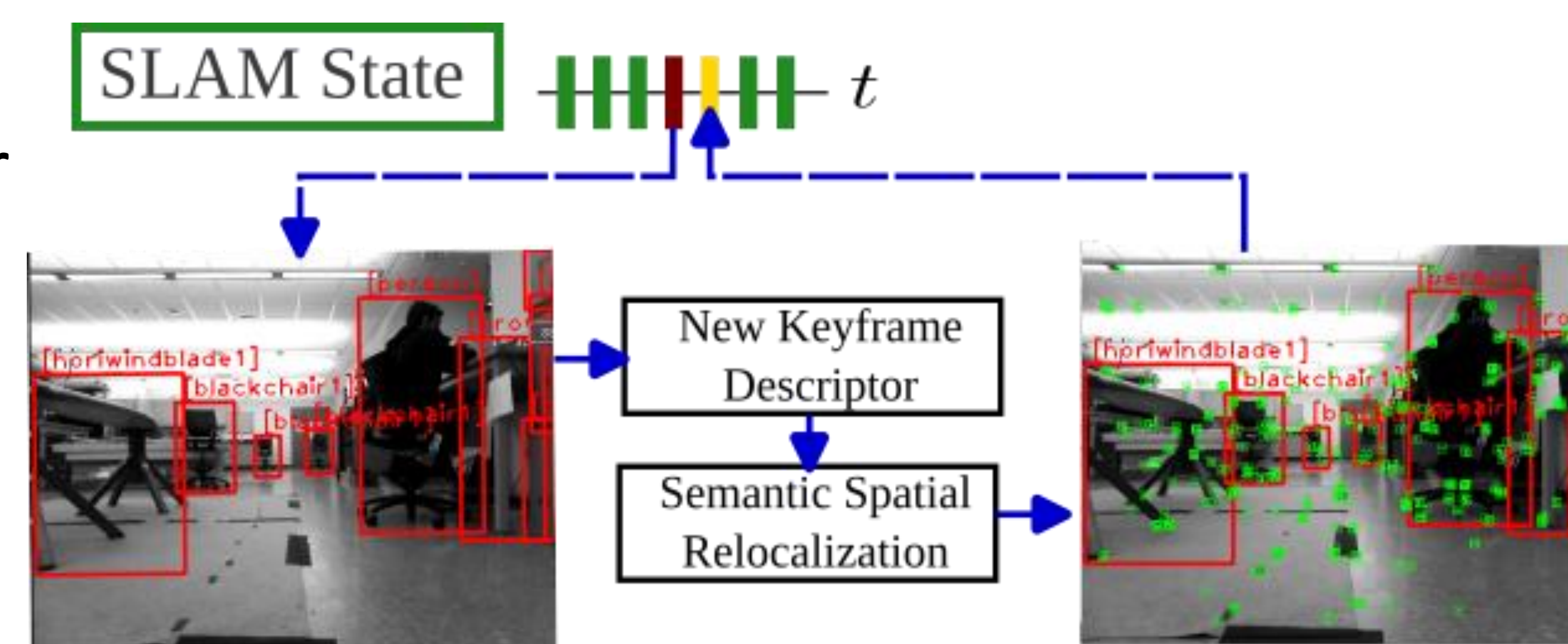
2. Control-planning architectures

- Coverage path planning for defect removal
- Real-time control system based on surface roughness estimation



3. Multi-robot semantic localization

- Novel centralized localization system for multi-robot agents.
- Semantic knowledge used to define a spatial descriptor for robust place recognition.
- Collaborative mapping generation



Broader Impacts: Proposed architecture is applicable to large-scale manufacturing in industries such as: energy, transportation, aerospace, maritime, construction.

Outreach: LSU ME Capstone team build a scaled wind blade. Several components of the project have been demonstrated at ENGage LSU (middle school children). Materials used in Robotics classes.

References:

- [1] Y. Ding et al. "Next-generation perception system for automated defects detection in composite laminates via polarized computational imaging", CAMX Conference, 2021
- [2] J. Oubre et al. "Towards a fully autonomous robotic system for detection and removal of surface defects in fiber glass panels", submitted to IFAC ICONS, 2022
- [3] J. Nguyen et al. "Robotic Manipulators Performing Smart Sanding Operation: A Vibration Approach", accepted at IEEE ICRA 2022