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Integration of Robotics Codes and Standards into the Occupational Safety Engineering Curriculum

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Agenda

- Motivation
- Project Goals
- Module Design
- Implementation
- Evaluation Results
- Dissemination & Impact
- Conclusion

Motivation: Robotics Growth

- Robotics adoption +15% annually
- 1.7 million robots added (2017–2020)
- Collaborative robots increasingly common

Motivation: Safety Concerns

- Workplace injuries involving robots rising
- NIOSH identified many robotics-related incidents
- Safety codes not consistently applied

Motivation: Education Gap

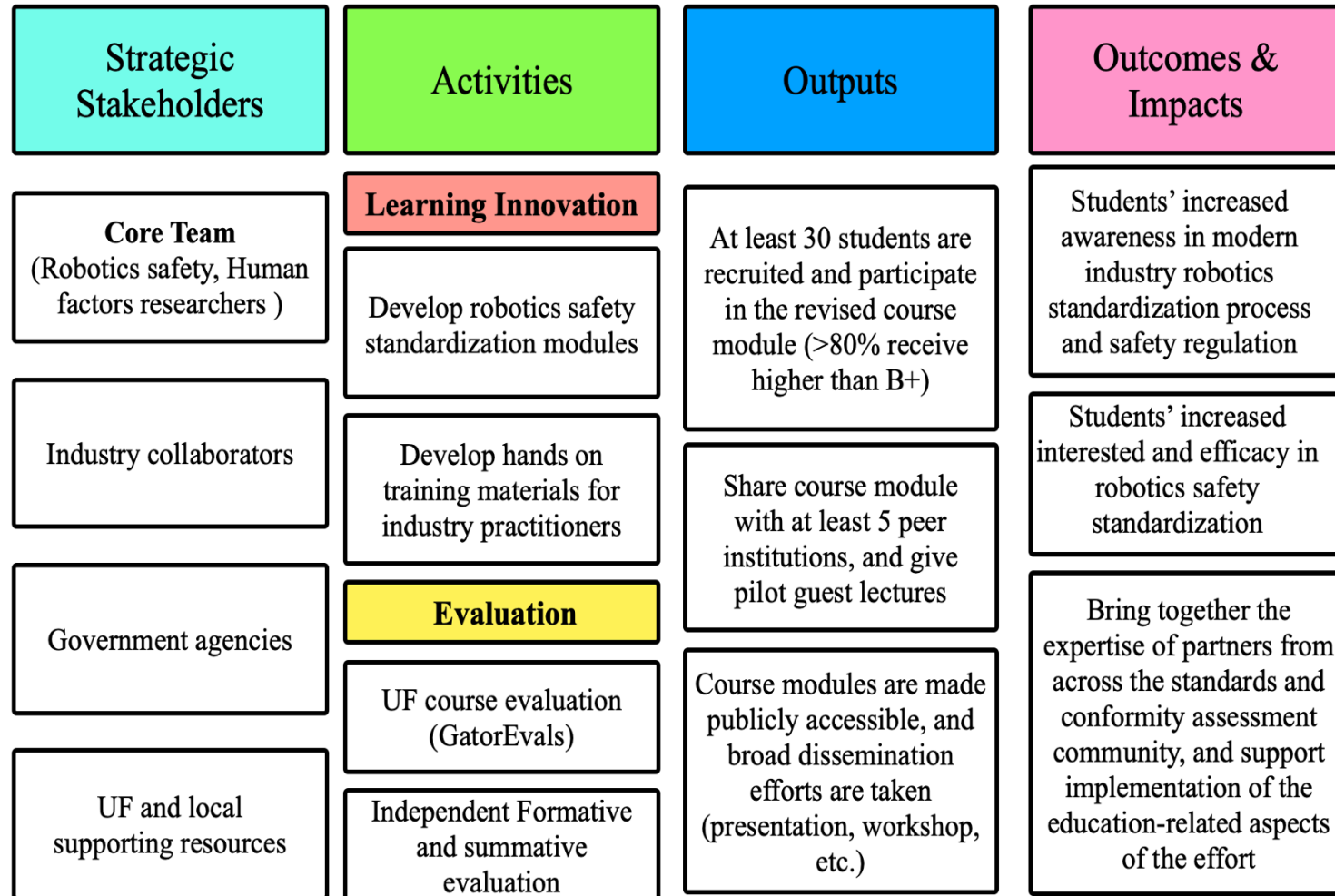
- Workforce lacks training in robotics safety codes
- Students rarely exposed to real-world standards
- Negative public perception of robotics (safety + job loss)

Project Goals (Overview)

- Develop open, modular instructional content
- Integrate into UF courses
- Make modules replicable elsewhere
- Bridge classroom and real-world robotics safety

Project Goals (Detailed)

- Embed in **Occupational Safety Engineering (EIN6216/4216)**
- Embed in **Human Factors Applications (EIN4245)**
- Focus on collaborative robotics & safety codes
- Support UF Safety Engineering Graduate Certificate



Module Design: Structure

- **4-week Occupational Safety module**
- **2-week Human Factors module**
- Standards covered: ISO 10218-1/2, ISO/TS 15066, ANSI/RIA R15.08
- Combined lectures, case studies, guest speakers

Module Design: Pedagogy

- “Learning by Doing” + collective learning
- Use of industry case studies
- Systems-level problem solving
- Open-source and modular content

Implementation: Occupational Safety Module

- Orientation session (Week 1)
- Industrial robot safety standards (Week 1–2)
- Mobile robot safety (Week 3)
- Guest lectures (Week 4)

Implementation: Human Factors Module

- Intro to industrial robotics and safety standards
- Guest lectures (IBM, LPRC, others)
- Case study: critique & redesign HRC system
- Group presentations and reports

Enrollment Growth

- EIN4216/6216: 76 students in Fall 2023
- EIN4245: 11 students (2022) → 48 students (2025)
- Exceeded expectations

Evaluation Results: Occupational Safety

- Graduate ratings: 4.4–4.7/5
- Undergrad ratings: >4.0/5
- Praise for enthusiasm, responsiveness, engagement

Evaluation Results: Human Factors

- Enthusiasm: 4.6/5 (2023)
- Workload concerns addressed in 2024
- Improved with targeted quizzes & in-class practice

Dissemination Channels

- Open-access website: nistufl.netlify.app
- UF EDGE (distance learning)
- Guest lectures at peer universities
- Workshops & conference sessions

Dissemination Partners

- Universities: Buffalo, WVU, NCSU, TAMU
- Industry: IBM, LPRC, ANSI
- Federal agencies: NIOSH, USDA, NSF, FDOT

Broader Impacts

- Strengthened workforce in robotics safety
- Bridged academia–industry collaboration
- Reduced barriers to adopting collaborative robotics
- Enhanced public trust in robotics

Lessons Learned

- Students need applied, real-world context
- Balance group projects & individual accountability
- Industry partnerships critical for relevance
- Open-source design ensures replicability

Future Directions

- Expand modules to new UF courses
- Extend dissemination nationally
- Develop short industry training workshops
- Continue updates with new standards

Conclusion

- Addressed critical educational gap
- Developed scalable, replicable modules
- Strong student engagement and feedback
- Prepares workforce for safe human-robot collaboration

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