Leveraging Smart Manufacturing to Create Employment Opportunities for People with Disabilities in Manufacturing Industry

One in four adults in the working age group in the U.S. lives with a disability. According to data from the US Department of Labor, only 20% of people with disabilities (PWDs) are able to find work. Work identity is considered a requirement for living a meaningful and fulfilled life; people living with disability face the dual hardship of having to endure challenges of living with a disability and limited financial resources. PWDs are often found to be loyal employees with outstanding work ethics. They also exhibit a significant amount of commitment to their jobs. On the other hand, there is a serious shortage of workers in the US in the manufacturing sector. We believe that the manufacturing industry should expand the pool of available workers and look into hiring people with disabilities.

Historically, because of the physical nature of most manufacturing tasks, it is very difficult for PWDs to get jobs in the manufacturing sector. *Our thesis is that the advent of new technologies that augment human capabilities and new manufacturing approaches present a unique opportunity to overcome this challenge*. The recent advances in smart manufacturing such as collaborative robots, artificial intelligence (AI), supervised autonomy, teleoperation, and telepresence technologies are changing the nature of work in the manufacturing industry so that it is no longer confined to challenging physical work. Forced by the pandemic, many companies have begun to utilize remote work practices to remain operational, decomposing manufacturing processes to subtasks that can be performed by workers without being present on-site. These developments are pointing to a future where PWDs can be integrated into the manufacturing workforce. *In light of these ongoing and anticipated future advances, we envision a future where PWDs, people without disabilities, robots, and AI-based smart manufacturing tools will form productive teams to work efficiently and safely in the manufacturing sector*.

Worker safety considerations have been a deterrent in the manufacturing sector when considering employing workers with disabilities. We need to convince industry that there are viable pathways to manage safety risks, offer workplace accommodation in a cost-effective manner, and train PWDs to be integrated in the workforce. Increasing employment opportunities for PWDs will require a convergent approach and bring potential stakeholders together and identify addressable aspects of this research challenge. We are starting an effort in this area by understanding the barriers to placing PWDs in advanced manufacturing jobs. This requires generating a comprehensive mapping of the abilities of persons from different disability groups onto basic actions needed to perform common tasks in manufacturing jobs. We also aim to understand the user-perspective, as well as safety productivity and labor economics considerations to increase employment opportunities for PWDs. In addition to including advanced manufacturing and assistive technology experts, our team also includes perspectives from social workers, labor economists, and rehabilitation experts to develop viable solutions. Workforce training programs are also an important aspect of our efforts.

We are proposing to investigate this challenge from task redesign, new assistive technology developments, AI-powered smart manufacturing solutions, novel human-machine interfaces (HMI), safety assurance, and workforce training perspectives. Specifically, we are interested in working on the following focus areas. (1) Technologies for safety prediction and control to predict unsafe conditions, issue alerts, and bring the user to a safe state during task execution. (2) A modeling and simulation framework to estimate the effort and skills required for a given task and use this information to screen tasks that cannot be safely performed with the aid of assistive technology. (3) Adaptive/assistive technology tools and workplace accommodations to enable workers to work safely and efficiently. (4) Telepresence and teleoperation technologies for enabling people with compromised motor skills to safely and efficiently perform manufacturing tasks through remote participation. (5) Robotics and automation technologies to reduce the physical effort and augment human capabilities to smart manufacturing. (6) New human-machine interaction approaches that empower PWDs. (7) Augmented reality-based tools for training of PWDs to learn safe and efficient task executions by accounting for potential contingencies. (8) Pilot studies to demonstrate that PWDs can safely and efficiently work in the manufacturing sector. (9) Training programs to empower workers with disabilities to self-advocate and showcase their unique abilities.