

Overview

Artificial Intelligence (AI) and increased connectivity offer a unique opportunity in manufacturing for better predictability, optimization, and enhanced reliability and safety. Nevertheless, challenges persist in systems efficiency, safety in human-robot collaboration, and cybersecurity, as well as a critical advanced technical skills gap. Therefore, in response to both “*Dear Colleague Letter: Centers of Research Excellence in Science and Technology (CREST Centers) Interest in Engineering Research*” and “*Aligning Fundamental Research and Education in Advanced Manufacturing with the Objectives of the Manufacturing USA Institutes*,” the California State Polytechnic University, Pomona (CPP) proposes to establish a CREST Center for Research Advancement in Smart Manufacturing (CREST-RASM). The **vision** of CREST-RASM is to become the model hub for innovation and research in smart manufacturing, bringing together a diverse community of researchers, industry experts, and stakeholders to develop groundbreaking solutions, technology, and best practices to transform smart manufacturing systems and enhance our nation’s workforce. In alignment with the Smart Manufacturing Institute (CESMII), a Manufacturing USA’s Institute, CREST-RASM’s **goals** are to: (1) develop novel and transformative research focused on highly integrated topics related to smart manufacturing systems intelligent factory, EXtended Reality (XR) in human-system integration, robotics and automation, and cybersecurity within the framework of a cyber-physical manufacturing facility; (2) increase the research capacity of CPP in smart manufacturing, and (3) develop highly impactful education and training programs that empower students, particularly from underrepresented minority (URM) backgrounds, to pursue graduate degrees in science, technology, engineering, and math (STEM) disciplines. The **mission** of CREST-RASM is to propel the manufacturing industry into a new era of efficiency, sustainability, and competitiveness. The initial award period is anticipated to result in numerous collaborative products and research experiences for over 80 undergraduates and 40 graduate students. In addition, the center’s education program aims to engage over 550 K-12 and 600 community college students, as well as 100 K-12 teachers. CREST-RASM is expected to sustain smart manufacturing research at CPP for the next 20 years.

Intellectual Merit

CREST-RASM has four thrusts that are transformative and address both fundamental and applied questions related to smart manufacturing. The thrust area of the *Digital twin-based factory* will focus on creating an intelligent factory with two-way data exchange between physical assets and their digital counterpart through an embedded AI within a bidirectional communication framework. The data exchange allows real-time commands to be sent back to the physical factory to enhance its operation, safety, and sustainability. The research thrust of *Virtual/augmented reality* will develop novel methods to enhance and expedite human-system integration through novel adaptive and immersive training protocols designed to be modular. The research thrust of *Robotics and automation* will focus on developing methods for autonomous grasping and re-grasping of objects by robots in a complex and dynamic manufacturing system. The thrust area of *Cybersecurity* will develop new communication standards and protocols to advance knowledge on device authentication which is an inevitable part of smart manufacturing systems. Together these research thrusts shape the future of secure, sustainable, and efficient smart manufacturing systems.

Broader Impacts

CREST-RASM will play a key role in bridging the critical gap in smart manufacturing research and workforce. Given that 49% of CPP’s STEM students are URM, the center will also play a vital role in diversifying the science and engineering workforce, thereby elevating the socioeconomic status of urban communities. Graduates equipped with versatile skills in high-demand areas of smart manufacturing will enrich the STEM professional community, offering holistic solutions to complex manufacturing challenges of the future. Furthermore, given CPP’s urban location, diverse student body, and hands-on, experiential learning approach, the university is uniquely positioned to shape curricula, research opportunities, and support services to educate future STEM leaders nationwide. Research findings will be shared across sister California State University campuses and the broader STEM research community through presentations at local, regional, and professional conferences, workshops, publications, and a dynamic CREST-RASM website.