

2021-2022 GRANT RECIPIENT REPORT

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**MICHIGAN TECHNOLOGICAL UNIVERSITY
STEEL CURRICULUM DEVELOPMENT GRANT**



The Manufacturing and Mechanical Engineering Technology (MMET) department seeks to better utilize the materials science and engineering (MSE) pilot-scale metal/steel processing facility by updating the sensors and data collection capabilities to better align with Industry 4.0. Note that the equipment for steel casting, rolling, forging, stamping, and additive manufacturing already exists and is operational, and this proposal seeks to instrument the equipment for use by a wider range of disciplines on campus. Analysis of process (big) data with techniques such as machine learning will help produce highly capable manufacturing and mechanical engineering technology engineers for the steel industry.

The current metal/steel processing facility at Michigan Tech is a fully operational and functional processing facility; however, it does not meet Industry 4.0 standards. To implement Industry 4.0 technologies and practices a project team was formed through Advanced Metalworks Enterprise (AME), where a team of students were tasked to select a process and update it with Industry 4.0-capable technology. The student team met with the advisors on a biweekly basis throughout the academic year.

The process chosen to introduce Industry 4.0 technology was the metal melt and casting line. To improve the process for improvement, temperature measurement for the melt and molds were identified as being important to automatically collect for process improvement.

The goal of this effort was to automatically collect and log this data to a central database, as opposed to collecting data manually or having data stored on local

non-networked computers. While trying to better align the facilities with current Industry 4.0 practices, other considerations are ease of use, maximize efficiency, better process reliability/repeatability and improved overall safety. By making improvements with all these considerations in mind, a more beneficial learning environment can be created.

In addition to the completed tasks for this project, new lecture topics were added to three courses: Machine Tool Fundamentals and Applications, Machine Design I and Machine Design II.

Since the equipment has been purchased and installed, the remaining task is to assure the data collection meets the cybersecurity requirements by university standards. Upon completion of the upgrade to the casting line, two other processes have been identified for future Industry 4.0 upgrades: Moisture sensor addition on the green sand mixer and extrusion press sensor upgrade.