GRANT RECIPIENT REPORT

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MICHIGAN TECHNOLOGICAL UNIVERSITY
STEEL CURRICULUM DEVELOPMENT GRANT

The Manufacturing and Mechanical Engineering Technology Department at Michigan Technological University seeks to better utilize the pilot-scale metal/steel processing facility by updating the sensors and data collection capabilities to better align with Industry 4.0. The project 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 Technological University is a fully operational and functional processing facility. However, it does not meet Industry 4.0 standards. The chosen process is intended to introduce Industry 4.0 technology on the metal melt and casting line. A temperature measurement system for the casting area was identified as being important to automatically collect data for process improvement. The current metal melt and casting line has the following temperature measurement instrumentation:

- Manual melt temperature measurement track with a DigiTemp – Heraeus temperature display.
- Mold thermocouple temperature measurement to push data wirelessly to cloud.
- Optical emission spectrometer connected to a stand-alone computer.

Automatic data collection and storage was a key objective of this project. Storing data to a central computer eased interfacing. By better aligning the facilities with current Industry 4.0 practices, ease of use, maximized efficiency, better process reliability/repeatability and improved overall safety all become important considerations. By making improvements with these considerations in mind, a more beneficial learning environment can be created for Michigan Tech students.

To introduce Industry 4.0 technologies to the metal melt/casting line, three areas were identified to upgrade with sensors that automatically log data during the melting and casting process:

1. Melt temperature measurement with wireless connection.
2. Mold temperature measurement with thermocouples and wireless recording.
3. Video recording of the entire process.

There are now five data-gathering devices that include two cameras, the DigiTemp, Arduino and the Spectrometer. Implementing Industry 4.0 meant collecting all the data into one location, which the team completed by creating highways for data to travel from these devices. This required installation of a computer network within the foundry. The environment of the foundry proved to be a challenge while the team designed this mini-network. The foundry is a large, enclosed room with cement block walls. Wireless transmission was not as reliable as a closed-circuit network. Therefore, the first task was to have a contractor install a conduit to allow a new mini-network and to protect the network cables from the environment. Once all the devices were attached with network cables, all the cables were routed to the central computer, located in the middle of the room, and plugged into a centralized network router. This allows all the data to be collected in one location as opposed to multiple stand-alone systems. ✦