OMIC R&D TECHNOLOGY BOARD
CONCEPTUAL ABSTRACT

TITLE: Smart Cutting Tool (Phase 2 of M24)

RELATED ROAD-MAPPING DESIGNATION ID#: M65

SUPPORTIVE INDUSTRY: OSU, CG Tech, Kennametal, Caron Engineering

PROJECT TYPE: General Project

PROBLEM STATEMENT (What Are We Trying to Solve?): This project involves enhanced analysis from the smart cutting tool (Boring Bar) developed in Phase 1 of the project. The work done in Phase 1 has demonstrated the conceptual design of the multi-sensor embedded smart tool, and showed that the tool life can be estimated from signatures extracted from the sensor data. Along with the conventional approach, it is required to measure the actual tool wear periodically in the initial machining stages to train a machine learning model correlating the sensor data signatures with the tool life. It has been observed in literature and Phase 1 experiments that the relationship learned by the model could vary under different cutting conditions (i.e. surface speed, cutting depth, feed rate). As such, in Phase 1 and most of the literature, the tool life prediction is mainly done under consistent cutting conditions.

PROJECT DESCRIPTION: This project carries with it a very specific focus as outlined below:

The Phase 2 of this project will mainly solve two key problems that address the tool life prediction under varying cutting conditions:

> 1) Learning the relationship among sensor data signatures under different cutting conditions (i.e. surface speed, cutting depth, feed rate)

> 2) Making use of the learned relationship(s) to reduce or remove the training process for new cutting conditions and accordingly minimize the efforts for ground truth sampling.

The expected outcome should include:

> 1) New experimental data

> 2) New algorithms (based on e.g. transfer learning)

> 3) Associated prediction results and data analysis

Identify Related OMIC R&D Resources: Proposing researchers should use their best judgment in deciding on the optimal resources for the research. To further aid in this decision, the OMIC staff has taken the initiative to best identify on-site resources (machines, equipment, and staff) that may relate to the scope of this research. Please recognize that researchers are not limited to these resources.

- o   Machines and equipment at OMIC can be reviewed at:
  https://www.omic.us/explore/facility
- o   OMIC Staff or SMEs

PROJECT DELIVERABLES:

- -   Final report
- -   Final presentation
- -   All built parts

SPECIAL NOTE: It should be recognized that this Conceptual Abstract is written based on comments collected during OMIC R&D Road-mapping workshop and based on industries need for applied research. However, researchers as SMEs, are encouraged to lend specific technical feedback to further refine the Project Description and/or Project Outcomes. The proposing researcher may do so either directly to OMIC R&D, or in the submitting proposal.

UTILIZATION OF OMIC RESOURCES: Researchers are encouraged to utilize the capital and personnel resources available on the OMIC R&D campus in their proposals. Use of OMIC time and machines should be included in the Proposal funding request. If use of OMIC resources are not identified in a proposal and are requested during, the project sponsor will be responsible for requesting a costed project amendment from the Tech Board.

PROJECT UPDATE EXPECTATIONS: Researchers are required to have monthly update discussion with OMIC R&D to provide a summary update on project status. This is done by way of a user-friendly format known as the OMIC 6-Block update. Typically, these meetings are scheduled on the first Wednesday and Thursday of each month. Secondly, depending on the scope of the project, OMIC R&D's industry Tech Board representatives are often interested in periodic project updates, and even in project participation. Researchers are required to communicate with supportive industry and facilitate communications as required.

ADDITIONAL COMMITMENTS TO FACTOR: Researchers may be asked to present their final project at an OMIC R&D biennial Technology Exchange Symposium. This symposium is an in-person event, held at the OMIC R&D campus in Scappoose Oregon. The Symposium is held in April, and researchers should factor in their availability when bidding on projects.

Researchers may be invited to participate in OMIC R&D's marketing efforts that showcase the working history of the project.

PROJECT DURATION: Its OMIC R&D's strong preference that duration of a General Project aligns with the academic calendar cycle (July 2024 to June 2025). It is preferred that the project be completed by June 2025. Researchers are encouraged to factor in variables such as contracting, student hiring (if needed), procurement, holidays, and travel. It has been OMIC R&D's experience that a project's useful working duration is typically 9 to 10 months. Researchers are also encouraged to give feedback, and to adjust the scope of work to best fit this preferred timeframe. Additionally, it is reasonable to even recommend phasing breakdowns to the project. In some unique circumstances, if the project is to take significantly longer than the duration of the academic year, this reasoning should be explicitly explained in the proposal.

CONTACTS AT OMIC R&D:

Urmaze Naterwalla	**Craig Campbell**	**Jen Kammerman**
Director of Research Operations	Executive Director	Research Administrative Manager
Urmaze.Naterwalla@oit.edu	Craig.Campbell@oit.edu	Jen.Kammerman@oit.edu