OMIC R&D TECHNOLOGY BOARD

CONCEPTUAL ABSTRACT

TITLE: OMIC-R21 Robot Haptic Feedback P2 of OMP433

RELATED ROAD-MAPPING DESIGNATION ID#: R21

SUPPORTIVE INDUSTRY: BOEING, Cobot Team, Caron Engineering.

PROJECT TYPE: **General Project (Phase 2 of OMP433 – R1-Y5-FY22)**

PROBLEM STATEMENT (What Are We Trying to Solve?): In rigid part assembly, such a robotic solution system would be able to find part edges, detect and correct for object slip, track manipulated object pose, and update its trajectory to ensure proper part fixturing. Phase 1 of this project focused on the latter rigid object manipulation example as a proof of concept; Phase 2 seeks to achieve robotic manipulation success in the more challenging flexible part manipulation scenario (e.g., wire harness assembly).

PROJECT DESCRIPTION: Effective and robust methods for embodying the sense of touch are essential for continued progress in robotics. Tactile sensors offer a rich set of data about a robot's physical interactions with its environment; for example, tactile sensors on a robot's fingers can provide information about a grasped object's texture, shape, and inertia, as well as data that can be used to assess grasp quality, such as normal force, shear force, and vibration. Today, even after decades of research, tactile sensing is still an open research problem that continues to receive substantial attention from the robotics community. Furthermore, the translation of these concepts into the industrial manufacturing application space has been limited. Thus, the central goal of this project is to advance the intelligence, capability, and adaptability of robotic manipulators used in modern factory lines.
In industrial applications of interest to the project stakeholders (e.g., Boeing, Cobot Team), we envision wire harness assembly and rigid part assembly to be two scenarios in which a robot with the proposed haptic abilities would have a distinct advantage. For example, in wire harness assembly, the proposed type of system would have the ability to slide its gripper along unconstrained, flexible cables and detect when it reaches the termination point.

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.

- OMIC machines: The spectrum of capabilities at OMIC R&D can be reviewed at the following link: https://www.omic.us/explore/facility
- Collaborative Robots: Sawyer, Doosan H2017.
- OMIC Staff: Jordan Meader.

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PROJECT DELIVERABLES:

1. Identify technologies to meet task needs.
2. Improvement and scaling of original proof of concept.
3. Analysis of tactile and gripper performance.
4. Report & presentation.

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

PROJECT DURATION: It is OMIC R&D's strong preference that duration of a General Project aligns with the academic calendar cycle (July 2022 to June 2023). It is preferred that the project be completed by June 2023. 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 projects useful working duration is typically 9 to 10 months. Researchers are also encouraged to lend 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.

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