

THE BACKGROUND

Yuchi Zhao, graduated in Mechatronics Engineering from the University of Waterloo, collaborated with Waterloo's RoboHub to design a robotic feeding system for individuals with physical disabilities.

THE CHALLENGE:

Overcoming Limitations of Current Feeding Systems for Greater Accessibility

People with certain physical disabilities, such as amputation, motor neuron disease, and brain injury, may face difficulties during meals and other daily activities. Existing robot-assisted feeding systems often assume a fixed feeding posture, requiring users to lean forward for food access. Unfortunately, this approach excludes many patients with limited body mobility. Addressing this need, Yuchi sought to create a solution that would provide greater accessibility and independence for these individuals.

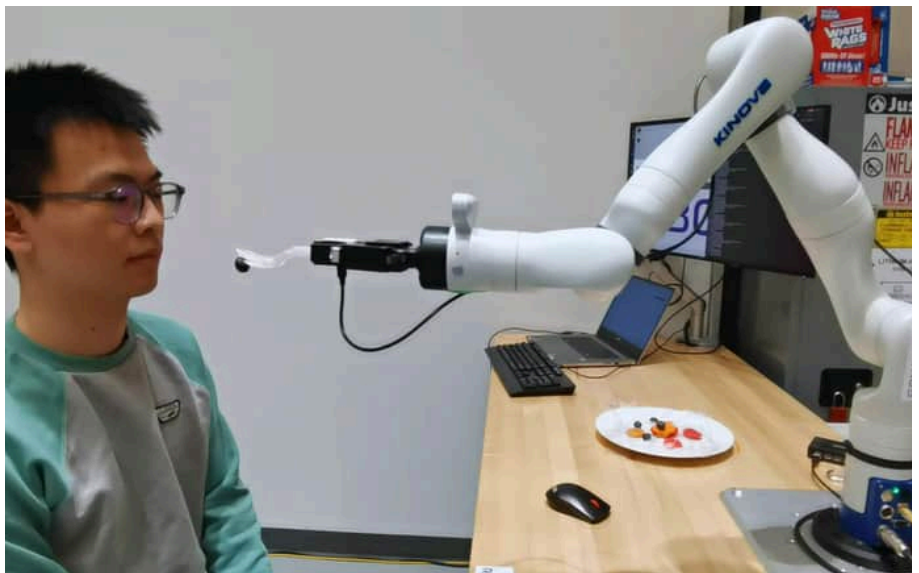


THE APPROACH:

Developing a Safe and Precise Robotic Feeding System with Kinova's Gen 3 Arm

Yuchi's Robofeeder system leverages the Kinova Gen 3 lightweight robotic arm, equipped with advanced visuo-tactile sensors. With the Gen 3's onboard RGB-D camera and custom facial landmark detection algorithms, the system accurately tracks the user's mouth to determine an optimal target for feeding. A visuo-tactile sensor on the arm's end effector detects contact with the user's mouth, allowing for real-time feedback to the closed-loop control. This ensures a gentle and precise feeding experience. When contact is sensed, the system immediately pauses, retracts, and completes a single feeding cycle, effectively moving food from plate to mouth with precision and safety.

The system is engineered to safely pick up food from the plate, transport it to the user's mouth, and perform in-mouth feeding with precision and care.



"I was super impressed by the robot weight. We could easily carry and mount it on the workbench. The Gen 3 does not have a control box, and it can be directly plugged into power. We set everything up within one hour. Using the web interface, we could quickly interact with the robot."

- Yuchi Zhao, Research Assistant at the University of Toronto

KEY OBJECTIVES:

To develop a robotic system that enables individuals with disabilities to feed themselves independently, handling each phase of the process—from picking up food to safe in-mouth feeding.

THE RESULTS:

The system was rigorously tested, successfully completing 20 feeding trials with various foods and at different user positions, achieving a 95% success rate and an average food delivery time of 78 seconds per cycle. Equipped with Kinova's Gen 3, the robot system demonstrated the ability to detect force and halt upon contact, ensuring user safety and comfort. The precision control of the Gen 3 allowed the robot to effectively perform delicate in-mouth tasks, which was essential to the project's success.



"I would recommend this product to engineers or researchers who seek a lightweight robot arm with high precision for various manipulation tasks. The Kinova Gen 3 is excellent for setup on a mobile base, forming a flexible mobile manipulation system suitable for use in indoor."

- Yuchi Zhao, Research Assistant at the University of Toronto

Kinova is a global leader in designing and manufacturing robot arm for various applications in the Industrial, Professional, Academic and Medical markets and for Assistive technologies. We have for mission to provide humanity with robots that empower them to achieve the extraordinary everyday.

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Together in robotics

