- Machine learning for robotic grasping
- Hyb-Re glove for hand rehabilitation
- Hyb-Knee for gait augmentation
- Colonoscopy view range expansion device

Sustainable & Intelligent Robotics Group Projects

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Industrial Robotics

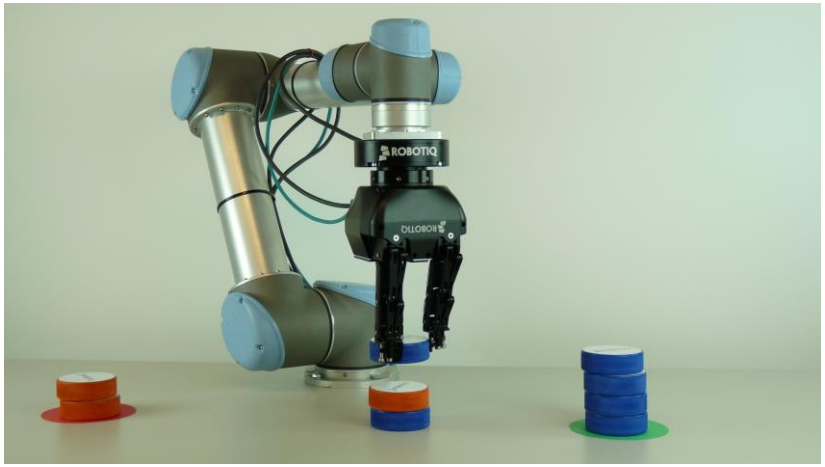
Machine learning for robotic grasping

Objective

Understand, develop and implement machine learning for adaptive robotic grasping with UR5 robot and Robotiq 3-Finger Hand

Description

Robotic intelligence is realized through the integration of mechanical, electronics and software components achieving tasks in an autonomous manner. In this project, the aim is to take advantage of the state-of-the-art robotic systems, including 6-axis UR5 robot arm and 3-Finger Robotiq gripper with FT sensor, to implement machine learning for autonomous item picking and place with self-optimized grasping strategy.

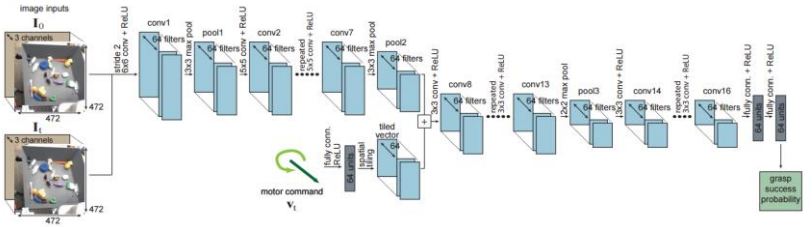


Student

Mechanical: Prepare the safety assessment of the robot and the gripper, install and test the robotic system, robotic analysis of the system with kinematics and dynamics

Algorithm: implement existing machine learning algorithm to achieve robotic learning with adaptive pick and place

Software: visualize the robotic system in ROS, implement a vision recognition system, visualize and integrate the algorithm for robotic testing



Wearable/Medical Robotics

Hyb-Re Glove for hand rehabilitation

Objective

Design and develop the 2nd generation of a hybrid rehabilitation glove for at-home hand rehabilitation

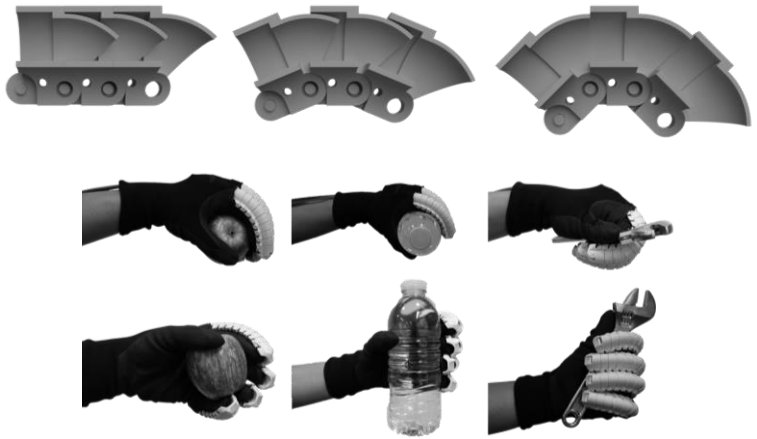
Description

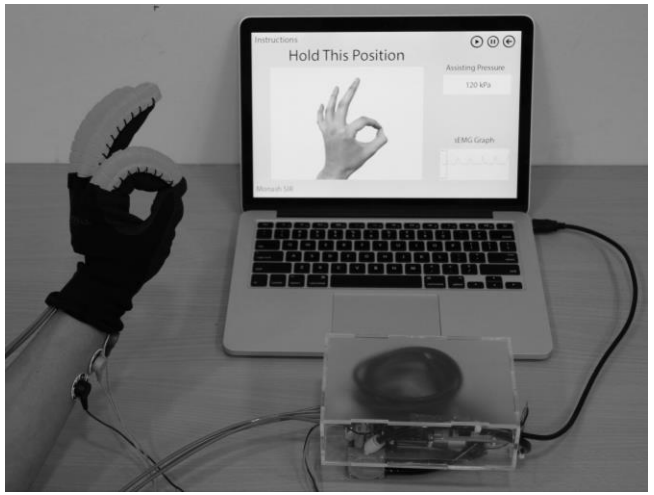
Hyb-Re Glove stands for **Hyb**rid **Re**habilitation Glove, which is a wearable device for hand rehabilitation for users with hand dysfunction. This is the 2nd iteration of the system, which is built on previous research progress at the CI's lab with proven results. The overall project outcome is to improve the system development for user end experimentation with safety consideration and sensor integration.

Student

Mechanical: propose new designs of the Hyb-Re Glove as a wearable device, systematically streamline the design process with variations and analysis, design for portability

Electronics: compact controller board design for portability, integration for sensing capability as a data glove, and sEMG signal processing and recognition





AncoraSIR

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Medical Robotics
Device to improve colonoscopic view and control

Objective: Miniature design and functional implementation of the proposed device.

Description: The proposed device comes from actual clinical need, aiming at introducing augmented view range for colonoscope during operation. Ideal design shall be attachable to the end of a typical colonoscope, where human safe actuation can be introduced to generate active control of the deployable mechanism for view range augmentation.

An illustration of such deployable mechanism design is shown on the right, where a pneumatic power source is attached to a deployable mechanism attached at the end of the colonoscope for controllable deployment. Other alternative designs include origami-based stent design with negative Poisson ratio under actuation.

The students are expected to propose viable designs and actuation mechanisms to iteratively prototype for the specific application. Major constraints include human-safe actuation and implementation, miniature design within limited space.

Students: **A team of 3~4 students is needed.** 1. Mechanism design and material selection; 2. Control and GUI; 3. Simulation-phantom and testing

This is a MIME funded project will be co-supervised by Prof. Sunita Chauhan, with further clinician support from Dr. Mayur Garg.

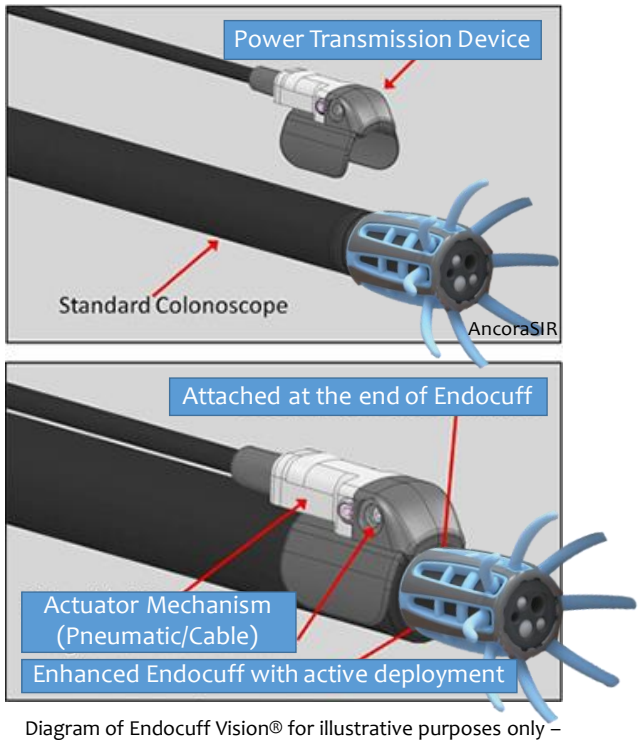


Diagram of Endocuff Vision® for illustrative purposes only – the actual device will be different in appearance to this.

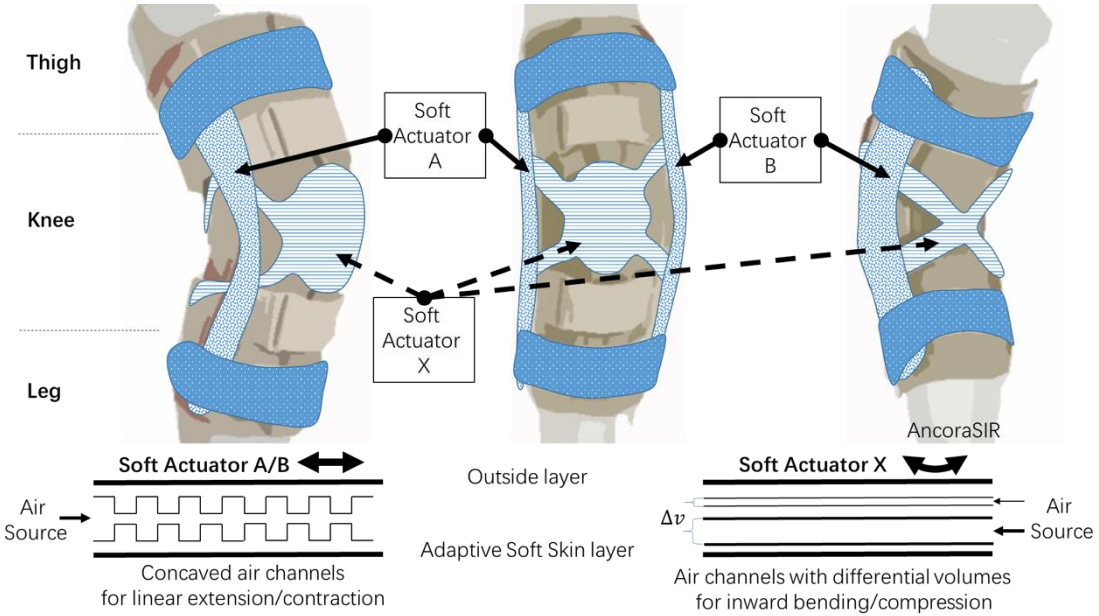
AncoraSIR

MONASH University

Wearable/Medical Robotics
Hyb-Knee for gait augmentation

Objective: Functional implementation of the proposed device with minimum design.

Description: The proposed wearable device is to be worn on the user's knee to achieve active orthopedic augmentation, helping patient to regain healthy gait in activities and daily life. The proposed device is powered by a series of soft actuators worn at the knee section as illustrated. A shell is to be attached outside the soft actuators to provide rigid support with constrained actuation. A fully-enclosed portable solution is preferred.



Prerequisites: Proven experience in design, prototyping, and electronics. Able to iterate fast to analyse, implement and test. Not afraid to get their hands dirty. Self-driven.

Successful implementation of the robot may lead to a fully funded travel to Shenzhen, China for experimental testing on ergonomics. Further development of this project work could lead to Graduate Research in the long term.

Contact

- Interested students are welcome to contact me by
  - Fill out the form at http://ancorasir.com/?page_id=143
  - Email me at Chaoyang.Song@monash.edu, or
  - Knock on my door at Room 116, 17 College Walk.

- Please specify the following while expressing your interests
  - Your intended project title and role
  - A CV with a brief introduction to yourself
  - Transcript with your most confident courses highlighted
  - A short paragraph of your career goal