



Indo/US Collaborative Research Grants

National Science Foundation of US and Technology Innovation Hubs of India



Title: Design, Development and Adaptive Control of Bistable Gripper based Unmanned Aerial Manipulation System

Indian PI: Dr. Spandan Roy, Assistant Professor, International Institute of Information Technology Hyderabad (IIIT-H), and PI in the grand project on Drone Applications in the I-Hub Foundation for Cobotics (IHFC), India.

US PI: Dr. Jianguo Zhao, Associate Professor, Colorado State University, US.

This US-India collaborative research aims to develop an aerial manipulator system integrated with an intelligent gripper and a method to control it. The developed gripper mechanism will be useful for aerial grasping because of its small weight and passive grasping capability. This will greatly enhance the practical operational capability of the aerial manipulators.

Existing research on aerial grasping generally uses traditional grippers actuated by motors, requiring sophisticated control algorithms for successful grasping from the air. However, if an actuator-less gripper can be devised then the operational capability of the aerial manipulator is greatly enhanced (e.g., more payload can be carried, increased flight time etc.) due to reduced weight. In this collaborative research, we will leverage the expertise of advanced controls (Dr. Spandan Roy, IIIT-Hyderabad, India) and mechanically intelligent grippers (Dr. Jianguo Zhao, Colorado State University, USA) to enable robust aerial grasping. Towards this goal, the proposed research will have two main tasks:

Task 1: Design and modelling of the bistable gripper: Zhao will aim to design gripper by using a bistable beam as the fingers. When triggered by the impact force, the straight fingers can wrap around an object with different shapes and dimensions. Meanwhile, Roy at IIIT-H will design the manipulator to host the gripper. We will also establish dynamics models for such an integrated platform.

Task 2: Adaptive control for aerial grasping (led by Roy). To allow the gripper to successfully grasp, the impact force between the gripper and the object should be controlled in a specific range. Roy will design an adaptive control framework to control the aerial manipulator to ensure a good impact force with minimal knowledge of uncertain system parameters and external disturbances.

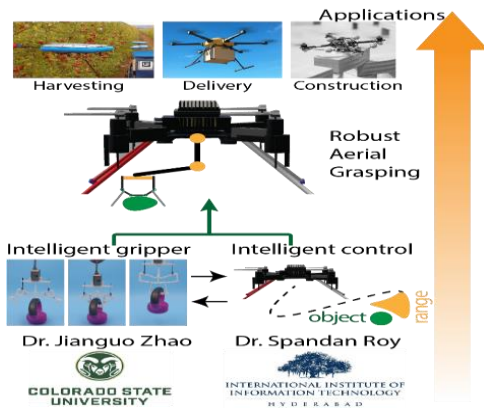


Fig. 1: Overview of the proposed collaborative project.



Fig. 2: Developed Prototype performing grasping and object manipulation operation.