



Aerial Manipulator

ABSTRACTS

An Aerial Manipulator system consists of two subsystems, namely a UAV and a manipulation mechanism employed to physically interact with the environment. These systems will help in express transportation, construction and maintenance, and manipulations in dangerous places that are difficult to reach for humans.

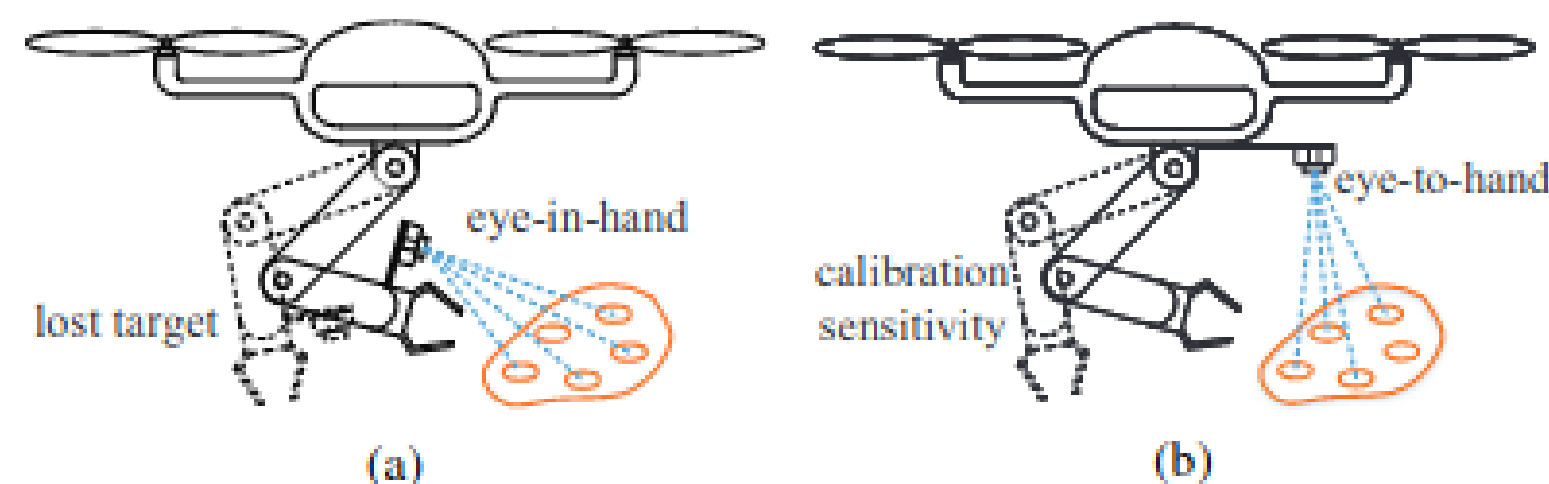
Autonomous grasping with an aerial manipulator in the applications of aerial transportation and manipulation is still a challenging problem because of the complex kinematics/dynamics and motion constraints of the coupled rotors-manipulator system.



OBJECTIVE

To develop Autonomous Aerial manipulator system which can pick or manipulate an object at a user defined position and place it at desired position or manipulate it into a desired orientation.

The main challenges are to navigate the drone in the area of the defined target object, accurately position and orient the drone and manipulator about the desired object and handle the dynamic disturbances during the time of manipulation.



METHOD

The project aims to achieve the objective through following ways:

- **Vision based object detection:** When the object is in the workspace of the manipulator, we employ image based visual servoing for precise adjustments for picking the object.
- **Motion planning :** The drone uses camera feed to navigate in the map by searching for the desired tag placed near our object.
- **Controller design:** We are exploring the area of adaptive controllers for variable payload systems and MPC based controllers for drone and manipulator kind of systems to solve this problem.

References

- Hossein Bonyan Khamseh, Farrokh Janabi-Sharifi, Abdelkader Abdessameud, Aerial manipulation—A literature survey, *Robotics and Autonomous Systems*, Volume 107, 2018, Pages 221-235, ISSN 0921-8890, <https://doi.org/10.1016/j.robot.2018.06.012>.
- Chen H, Quan F, Fang L, Zhang S. Aerial Grasping with a Lightweight Manipulator Based on Multi-Objective Optimization and Visual Compensation. *Sensors*. 2019; 19(19):4253. <https://doi.org/10.3390/s19194253>