Institut de Robòtica
i Informàtica Industrial

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Perception in Aerial Robotics for Inspection and Maintenance

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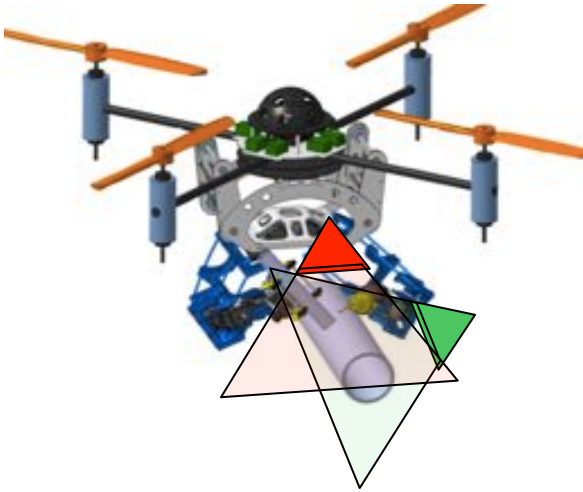
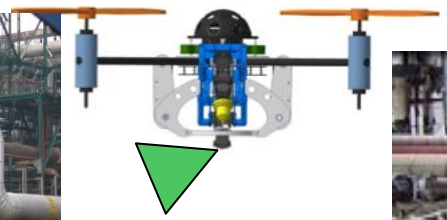
ERF2017 Workshop on Aerial Robotics Inspection
Edimburgh
24/3/2017

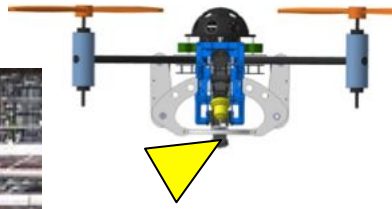
AEROARMS

AEROARMS Perception Objectives

The **main objective** of the Perception is to provide the needed perception functionalities to allow a reliable and accurate localization of the aerial robot for grabbing and manipulation.







Perception objectives for Inspection and Maintenance

Navigation: To move from the origin to destination without colliding with static and dynamic objects

Object tracking: Track the object for inspection, drilling, grasping, manipulation, etc.

Cooperative perception: Use multiple perception systems for inspection and maintenance tasks

Localization and Mapping: Create a global or local map and obtain the pose of the aerial robot

Object/area identification: Identify the objects for inspection, manipulation, landing, etc.

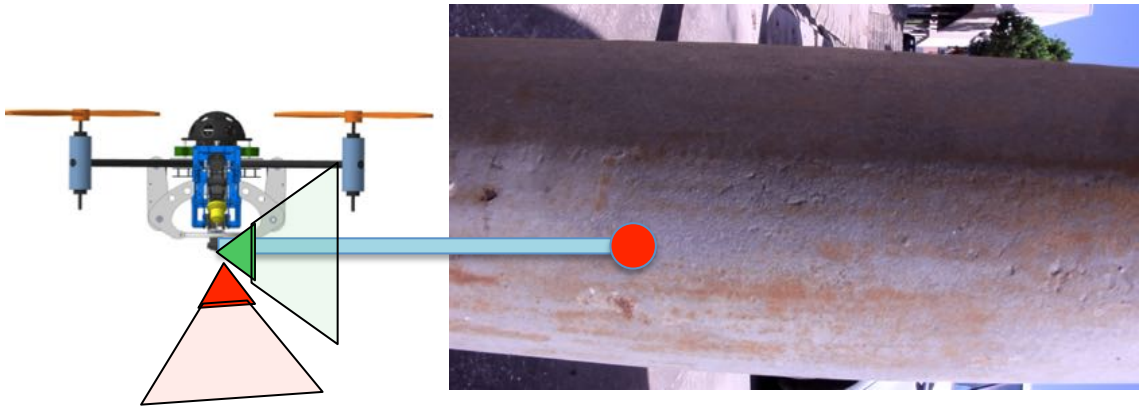
Localization and Mapping

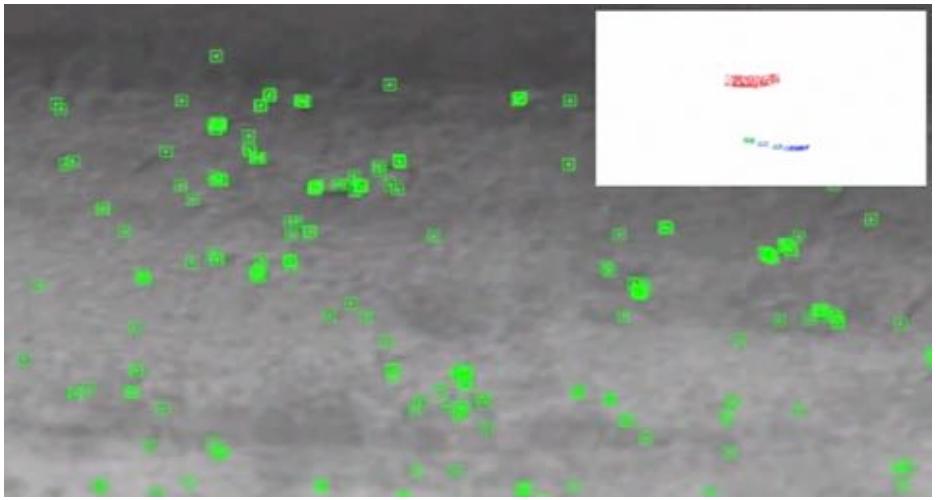
Map building and Localization

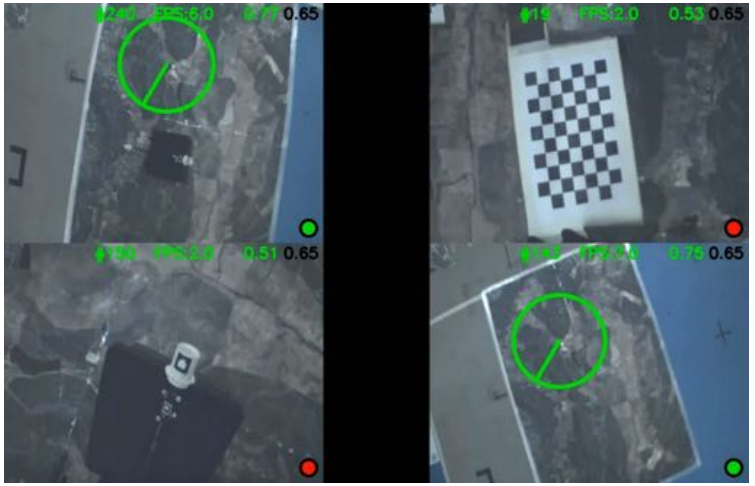
- Global localization
- Local localization

Global localization

Local positioning, mapping and pose detection





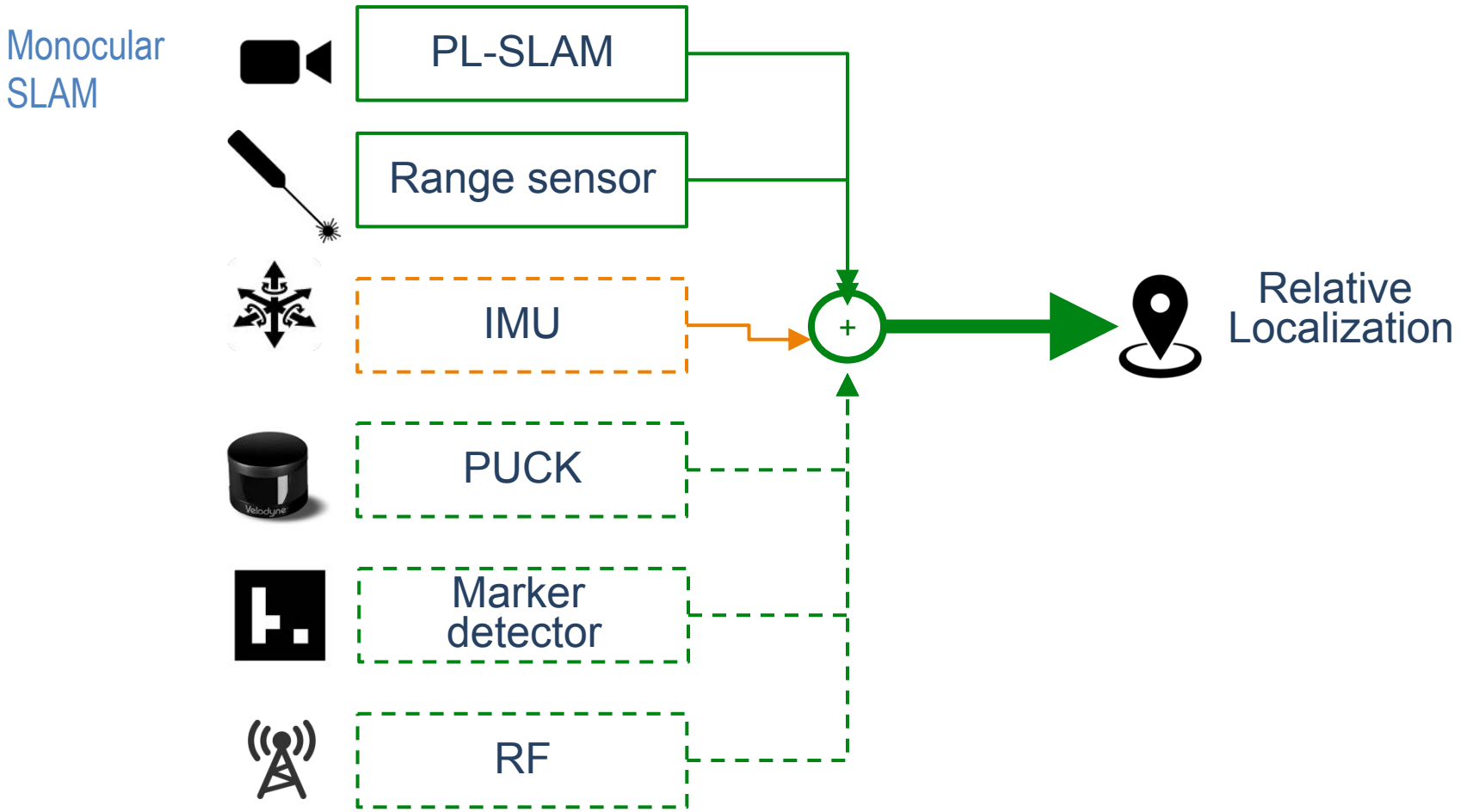


Local map building for local positioning

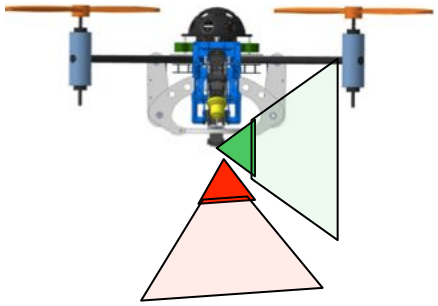
Pose detection

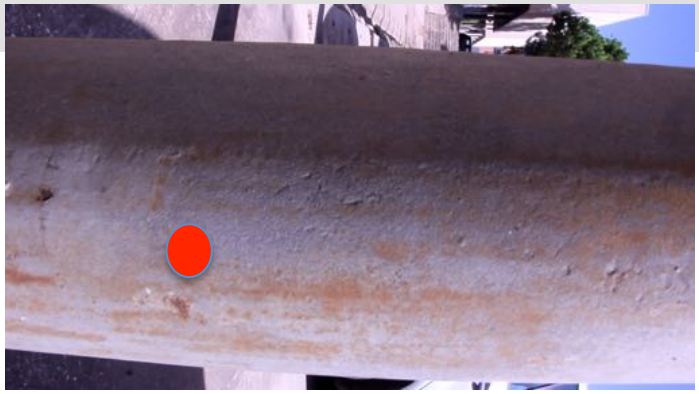
Inspected Pipe

Fusion for relative localization

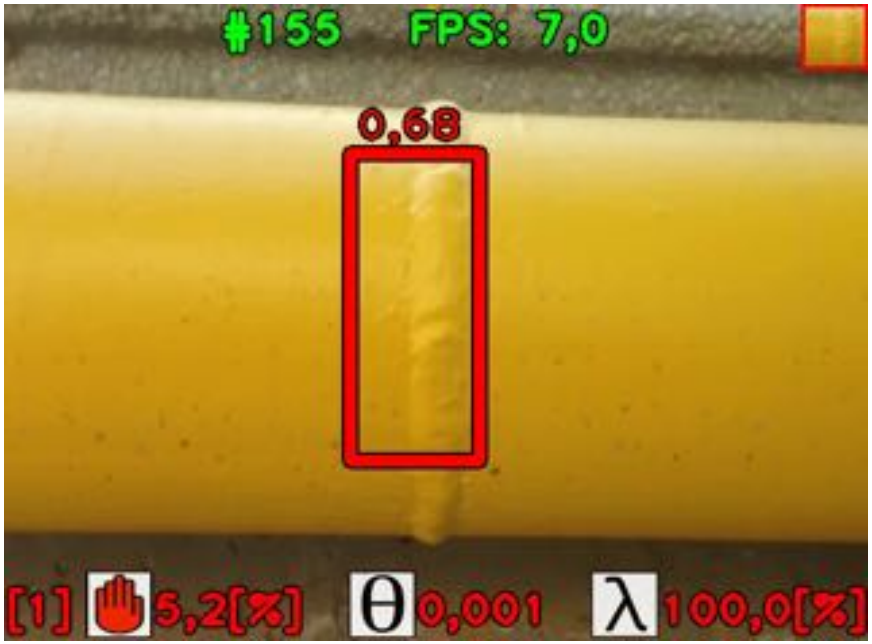


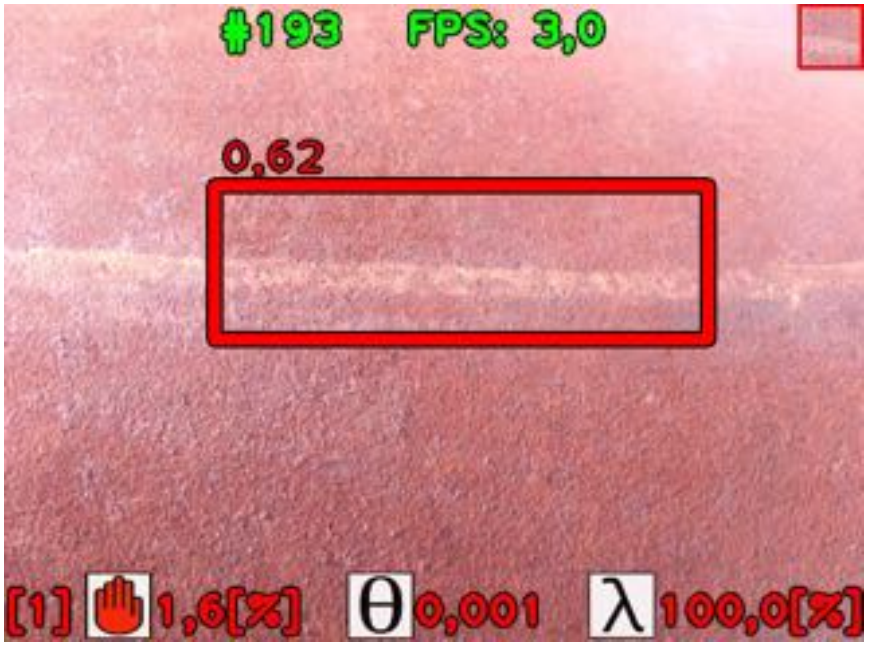
Object / Area Identification





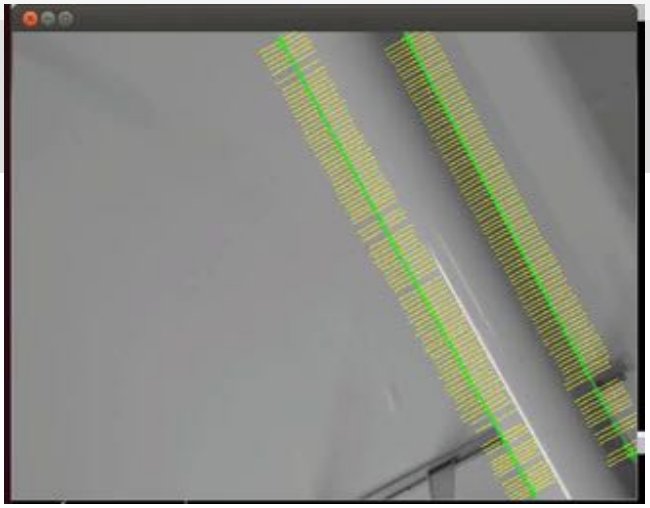
Identify the objects for inspection, manipulation, landing, etc.



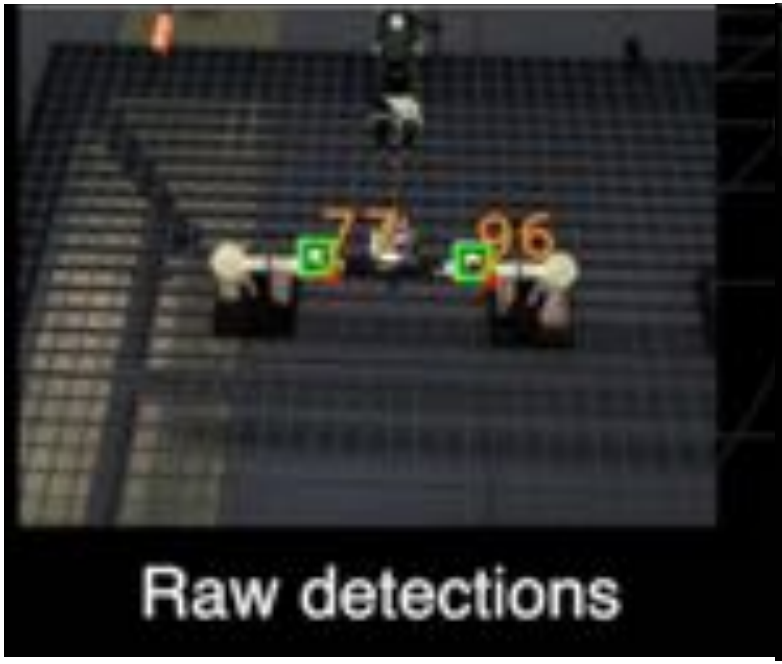


Object tracking

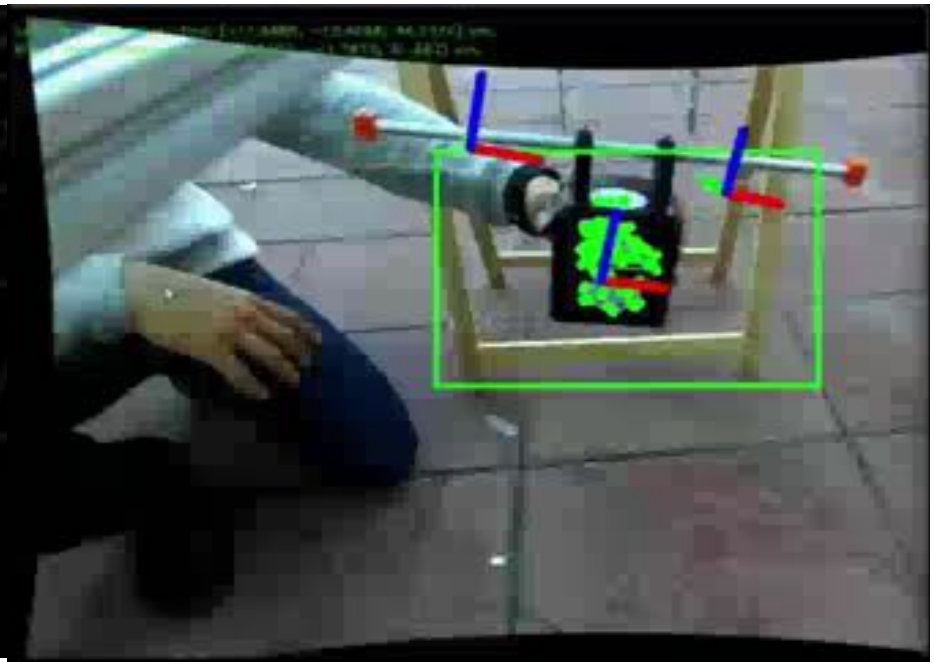
Pipe tracking

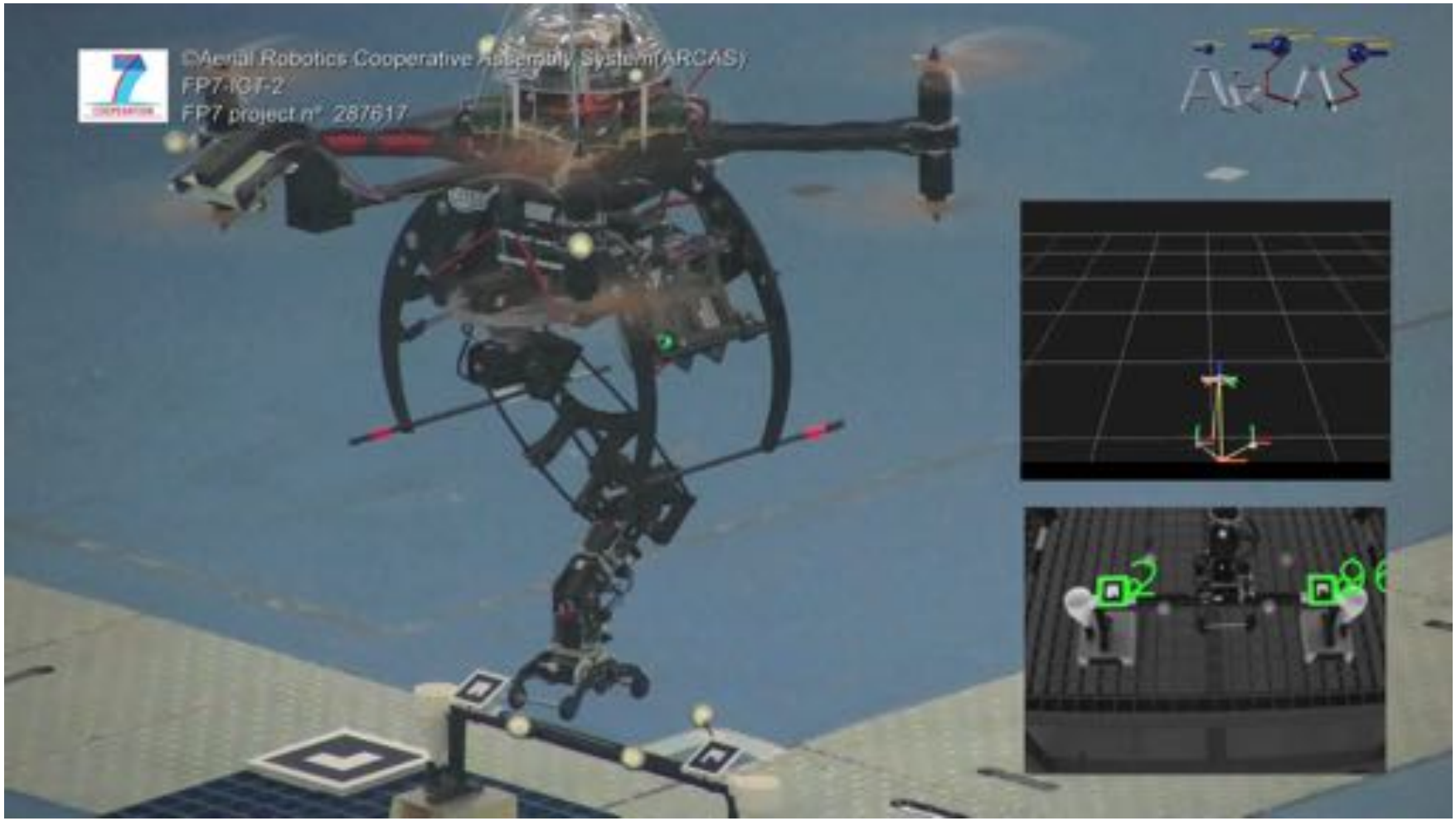


Tracking visual marks for insertion



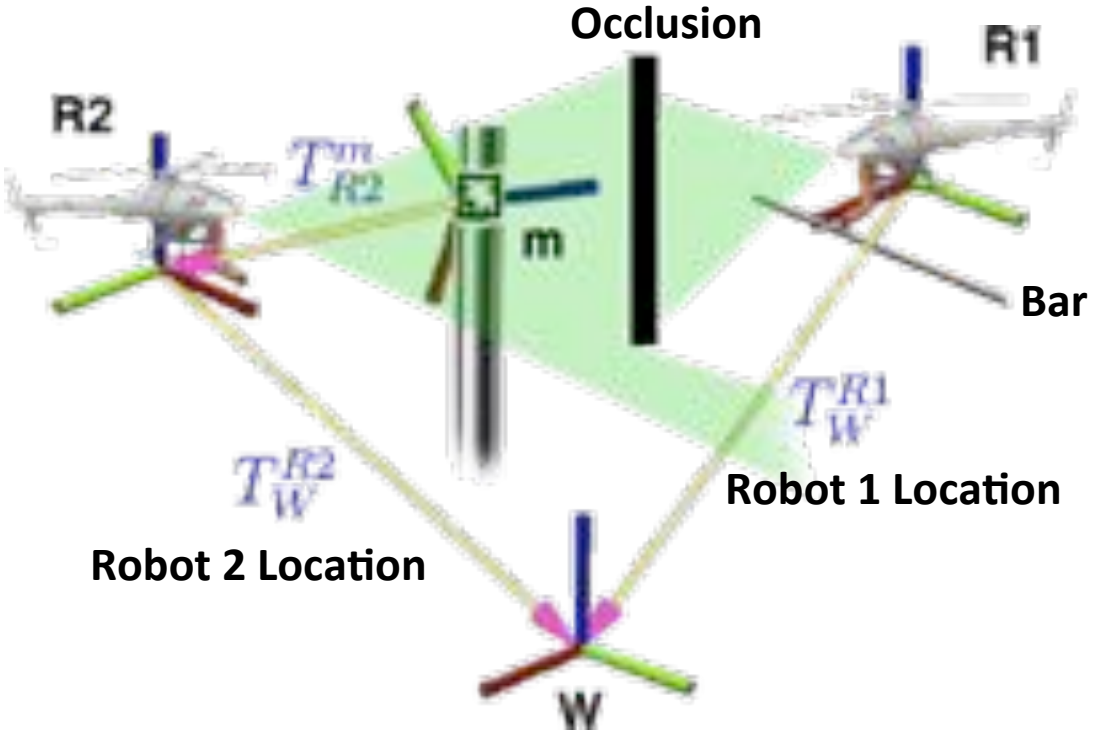
Object tracking for grasping




©Aerial Robotics Cooperative Assembly System (ARCAS)
FP7-ICT-2
FP7 project n° 287617

Cooperative perception

Problem: The robot performing the inspection or maintenance might encounter occlusion of the markers during the task.



Solution: Cooperative perception between two robots, when the marker is occluded for robot 1, we obtain the information of the marker's position from robot 2, and then transfer it to robot 1.

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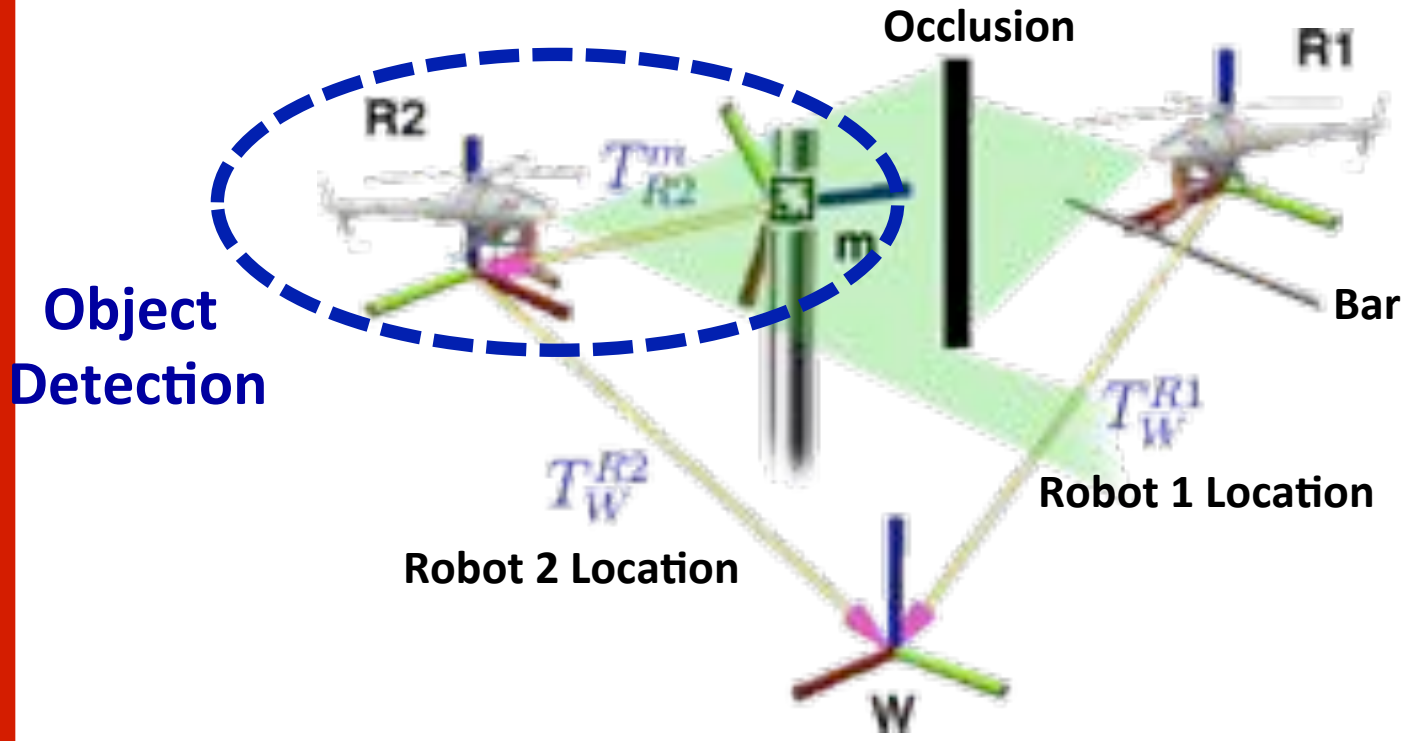

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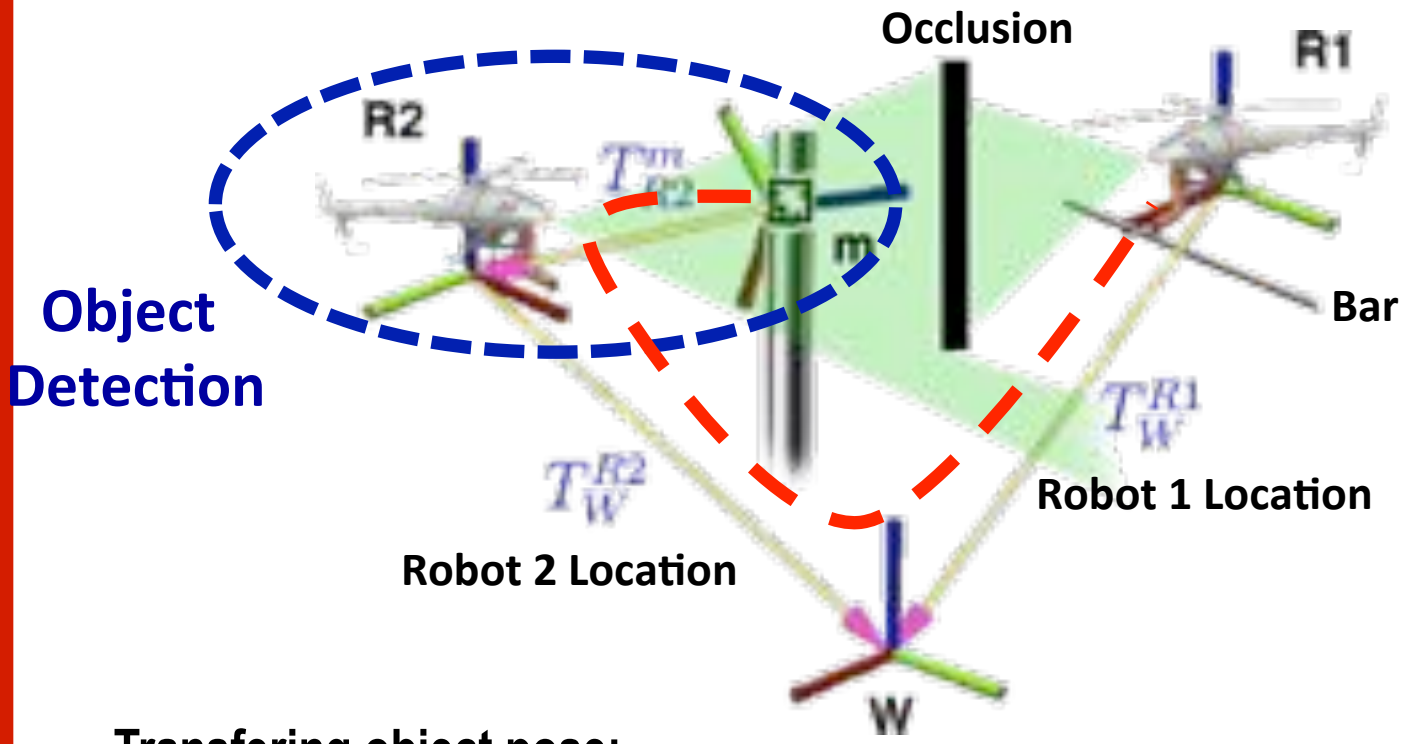


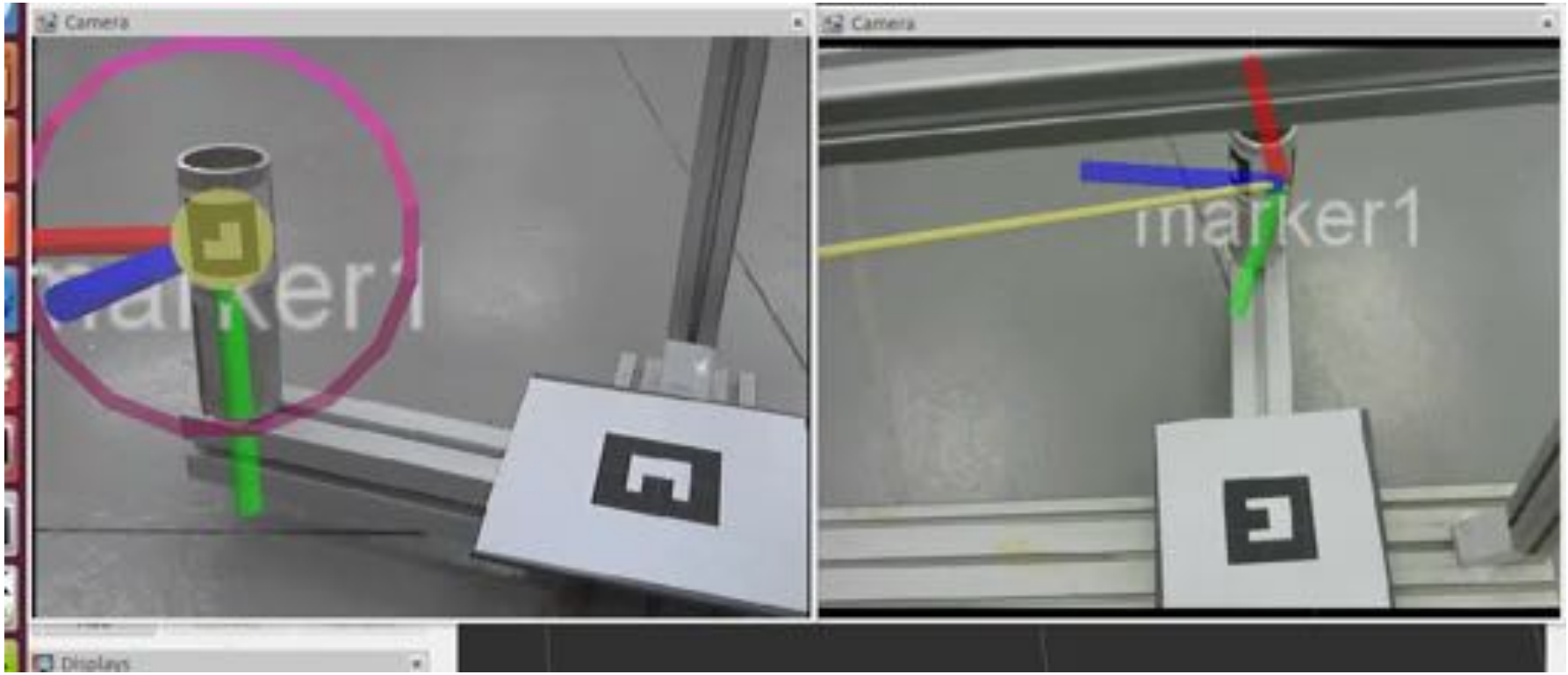
Transfering object pose:

$$\left.\begin{aligned} T^m_W &= T^m_{R2} \cdot T^{R2}_W \\ T^m_{R1} &= T^m_W \cdot \left(T^{R1}_W\right)^{-1} \end{aligned}\right\} T^m_{R1} = T^m_{R2} \cdot T^{R2}_W \cdot \left(T^{R1}_W\right)^{-1}$$

Cooperative perception

Experiments:

Camera 2 **Camera 1**



Thank you

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