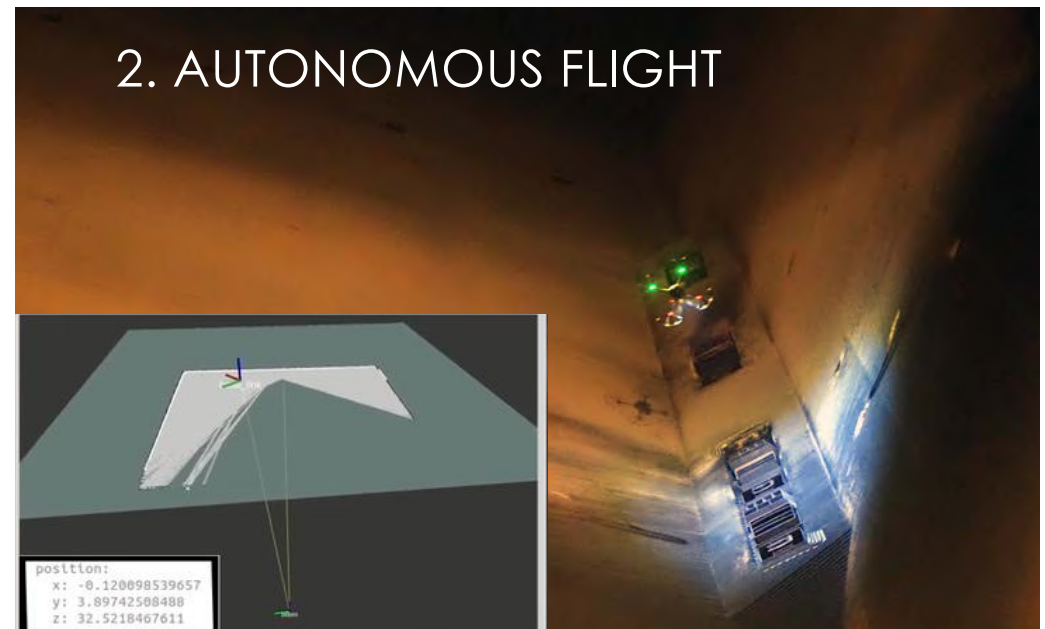
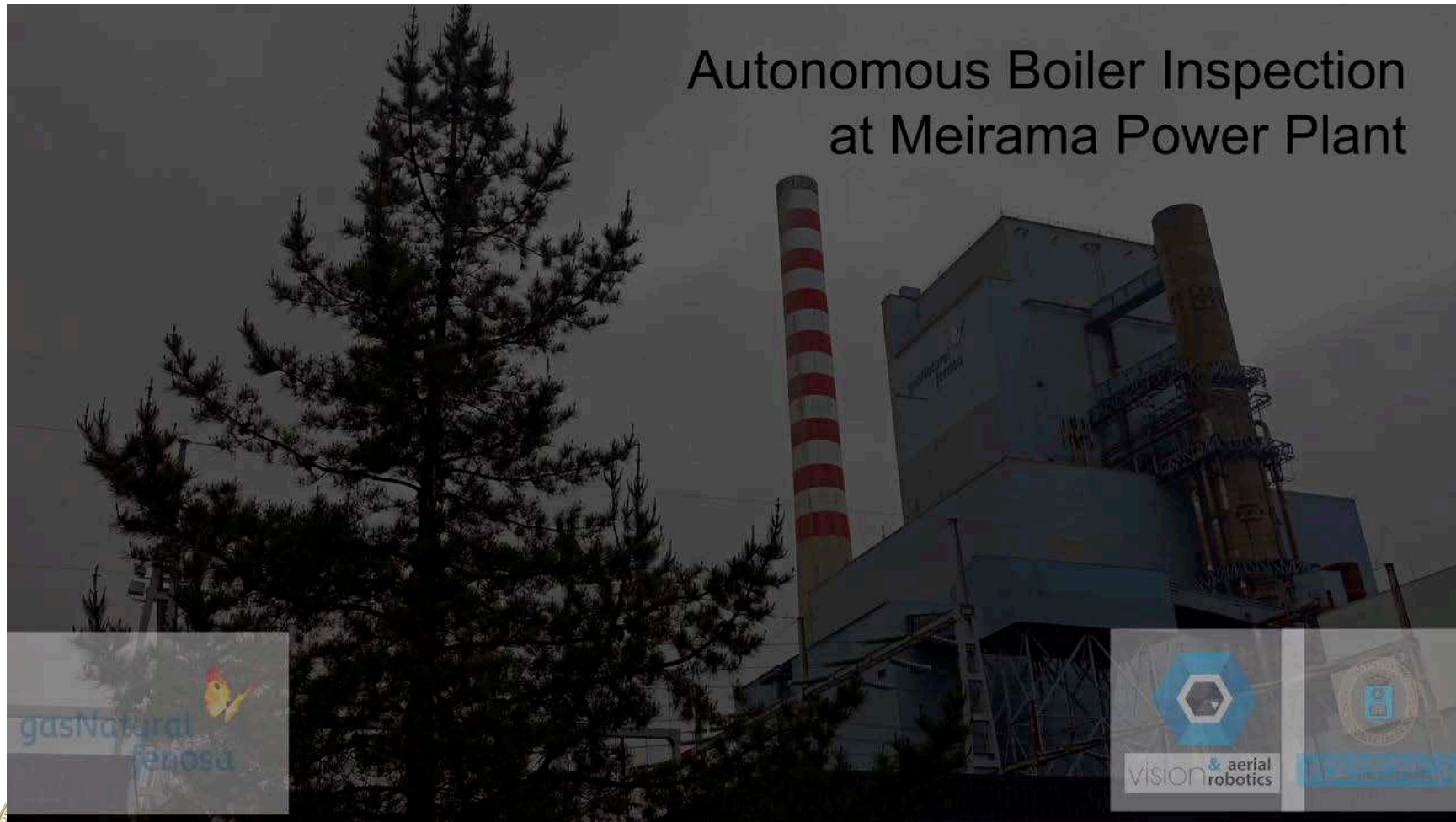


- **Environment understanding:** visual object detection and recognition (off-line or on-line)

- **Pose estimation + Visual Control and navigation**



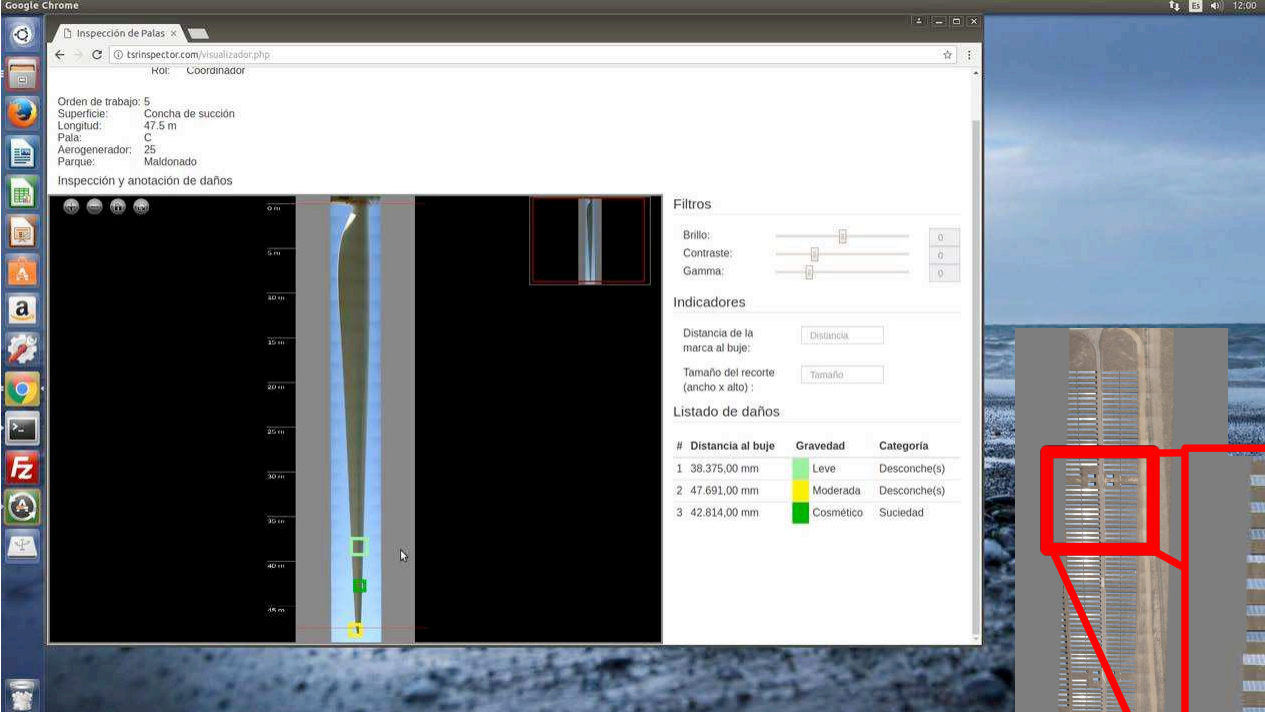
Industrial visual inspection: Boiler of a Thermal Power Plant



1. Image Analysis:

2D/3D environment reconstruction

Windmill blade inspection for Company TSR (2017)



Google Chrome

Inspección de Palas

tsinspector.com/visualizador.php

KOI: Coordinador

Orden de trabajo: 5
Superficie: Concha de succión
Longitud: 47.5 m
Pala: C
Aerogenerador: 25
Parque: Maldonado

Inspección y anotación de daños

Filtros

Brillo: 0
Contraste: 0
Gamma: 0

Indicadores

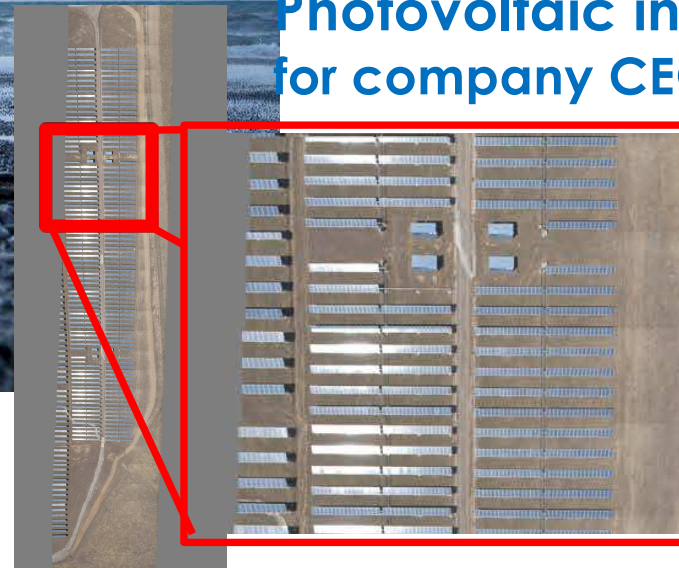
Distancia de la marca al buje: Distancia

Tamaño del recorte (ancho x alto): Tamaño

Listado de daños:

#	Distancia al buje	Gravedad	Categoría
1	38.375,00 mm	Leve	Desconche(s)
2	47.691,00 mm	Moderada	Desconche(s)
3	42.814,00 mm	Cosmético	Suciedad

Photovoltaic inspection for company CEGA drones

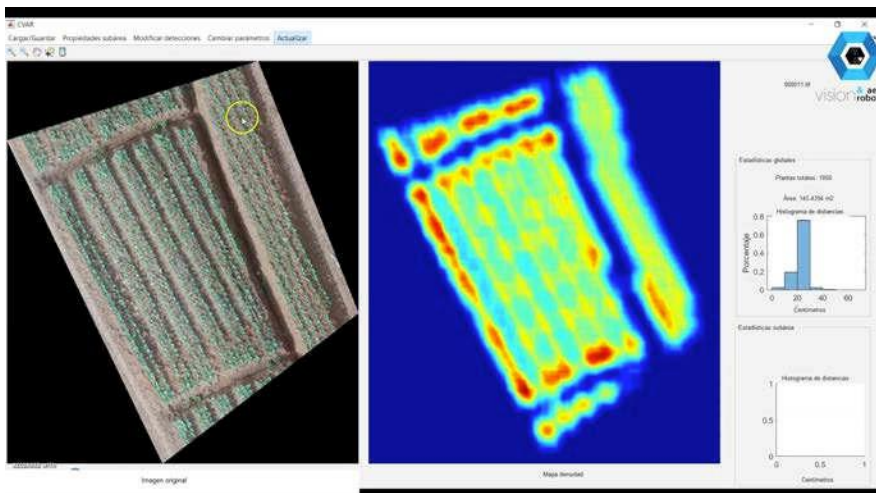
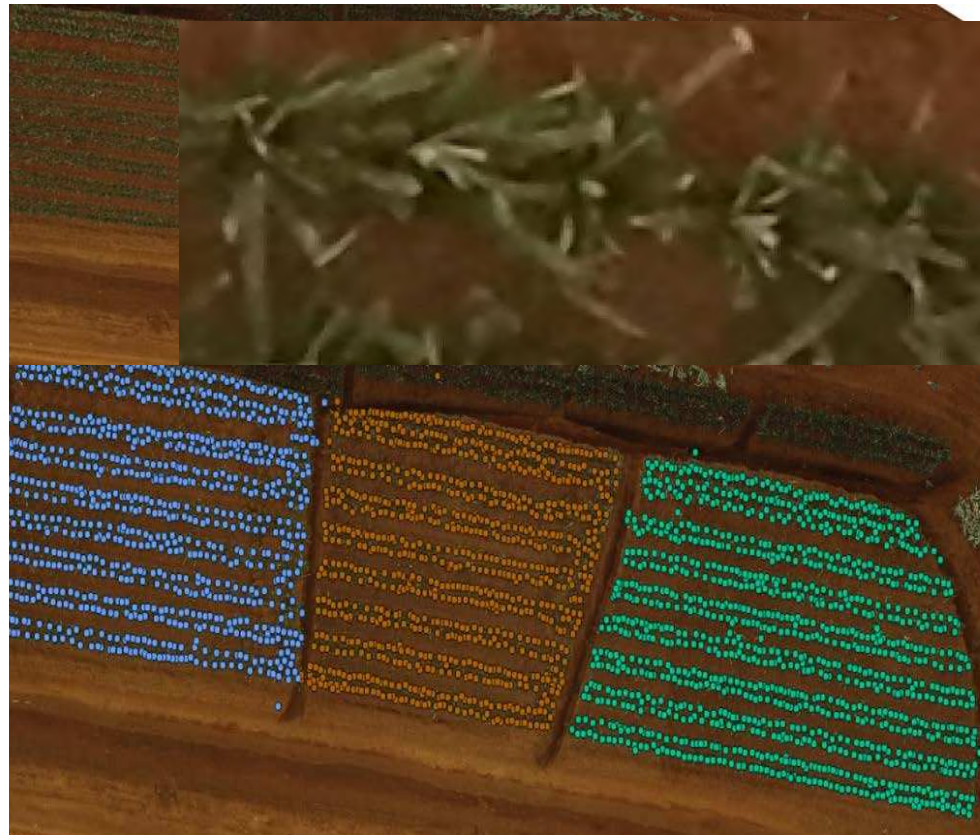




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1. Image Analysis: parts recognition

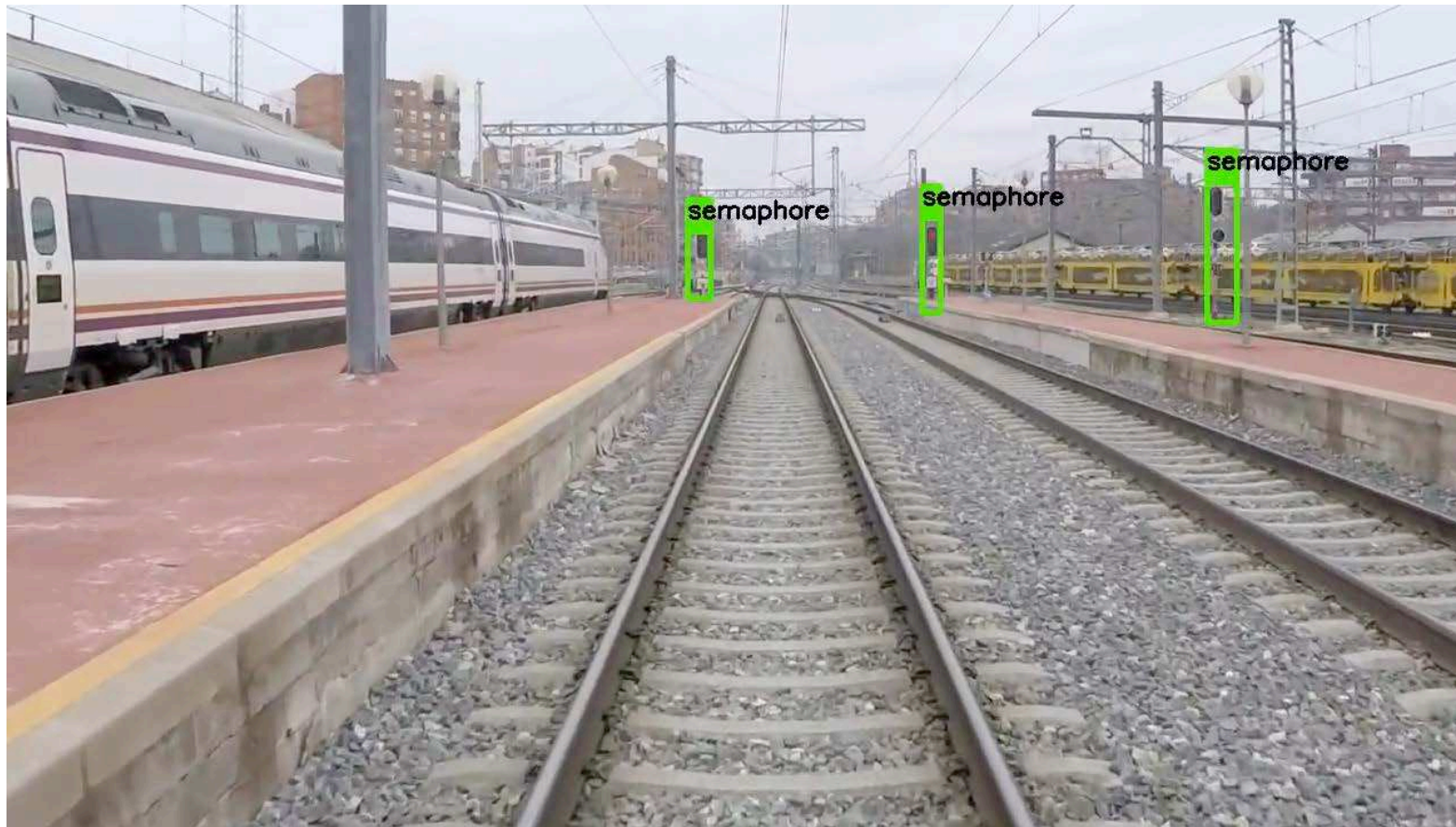
Precision agriculture: plants counting for company Indigodrones (C.R.) 2018



1. Image Analysis:

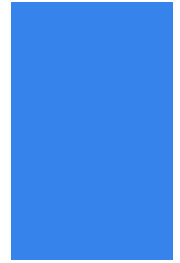
2D/3D environment reconstruction

Railway signal detection and recognition Sigma Rail 2019



1. Image Analysis:

2D/3D environment reconstruction



Isolator segmentation & defect detection by DL for REE 2018



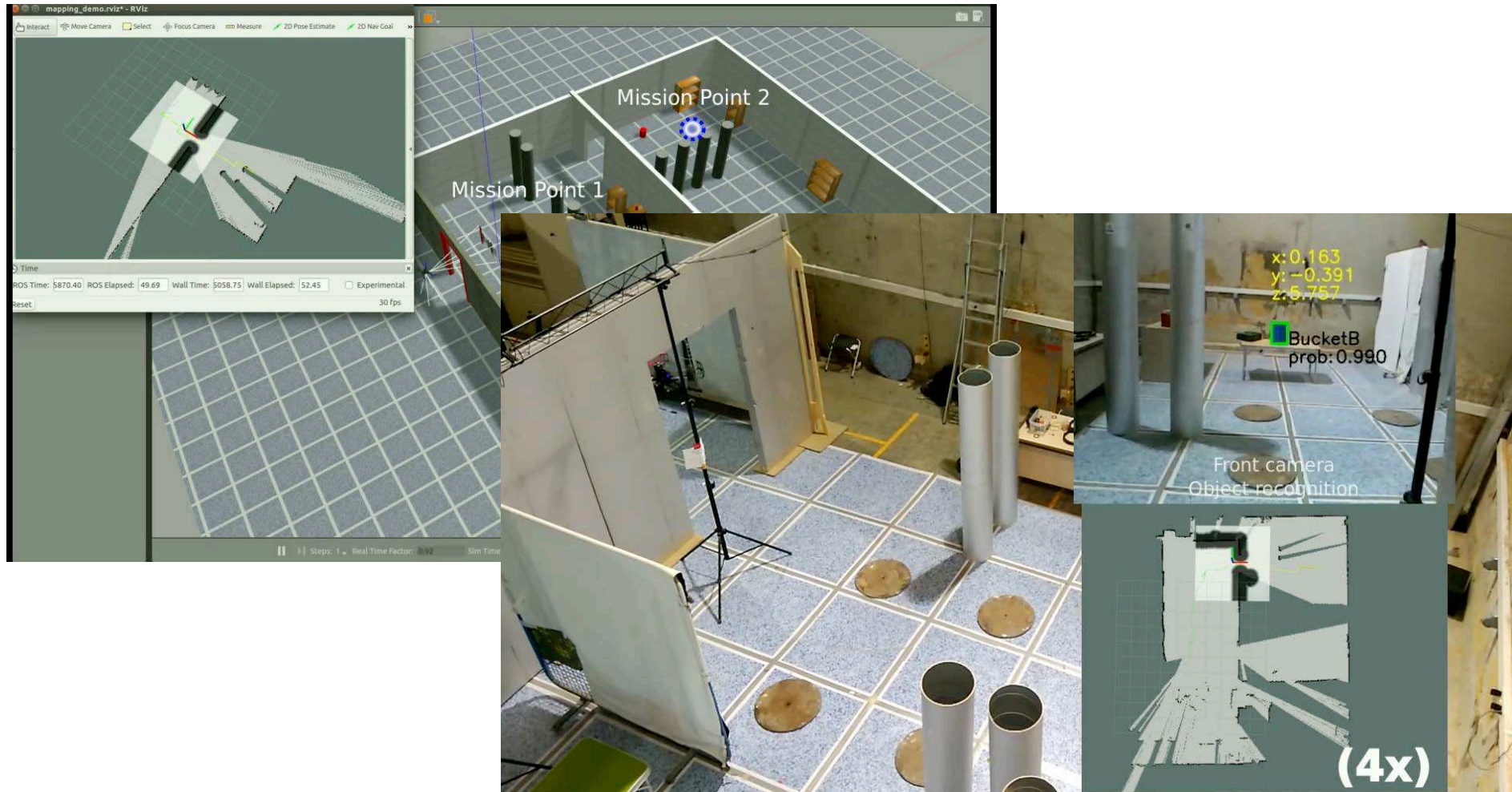


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2 Vision in Autonomous Flights

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Relevance of simulation



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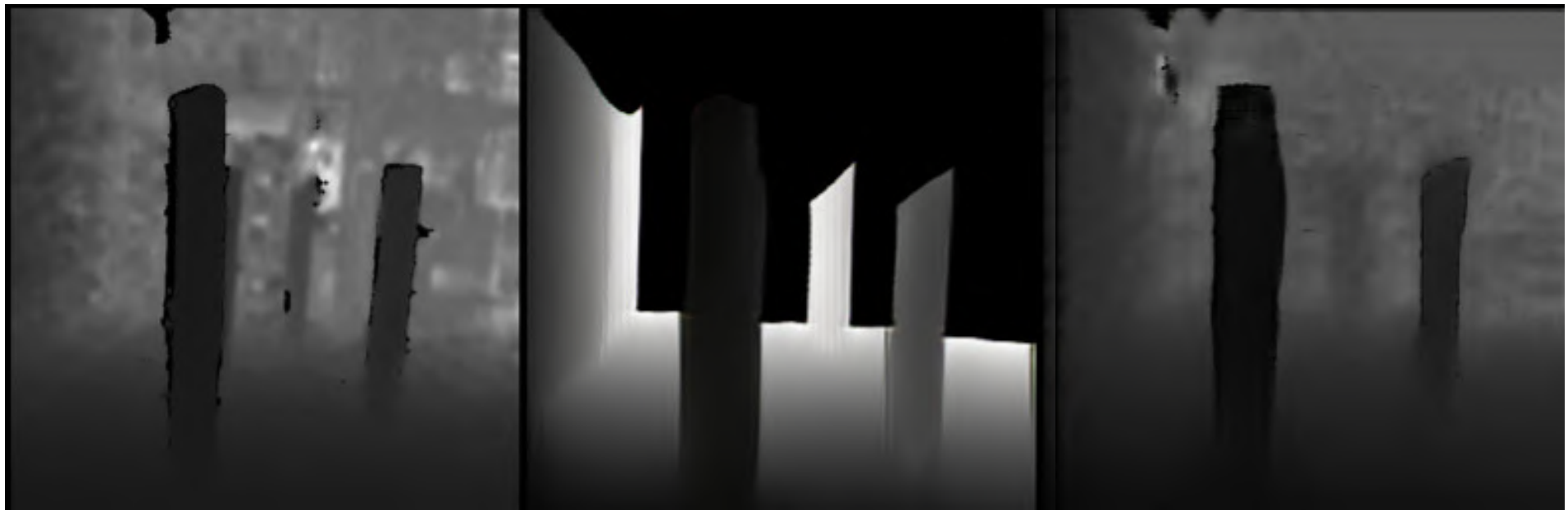


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2 Vision in Autonomous Flights

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Relevance of simulation



Real depth image

Synthetic image

→ Realistic image
by DL autoencoder



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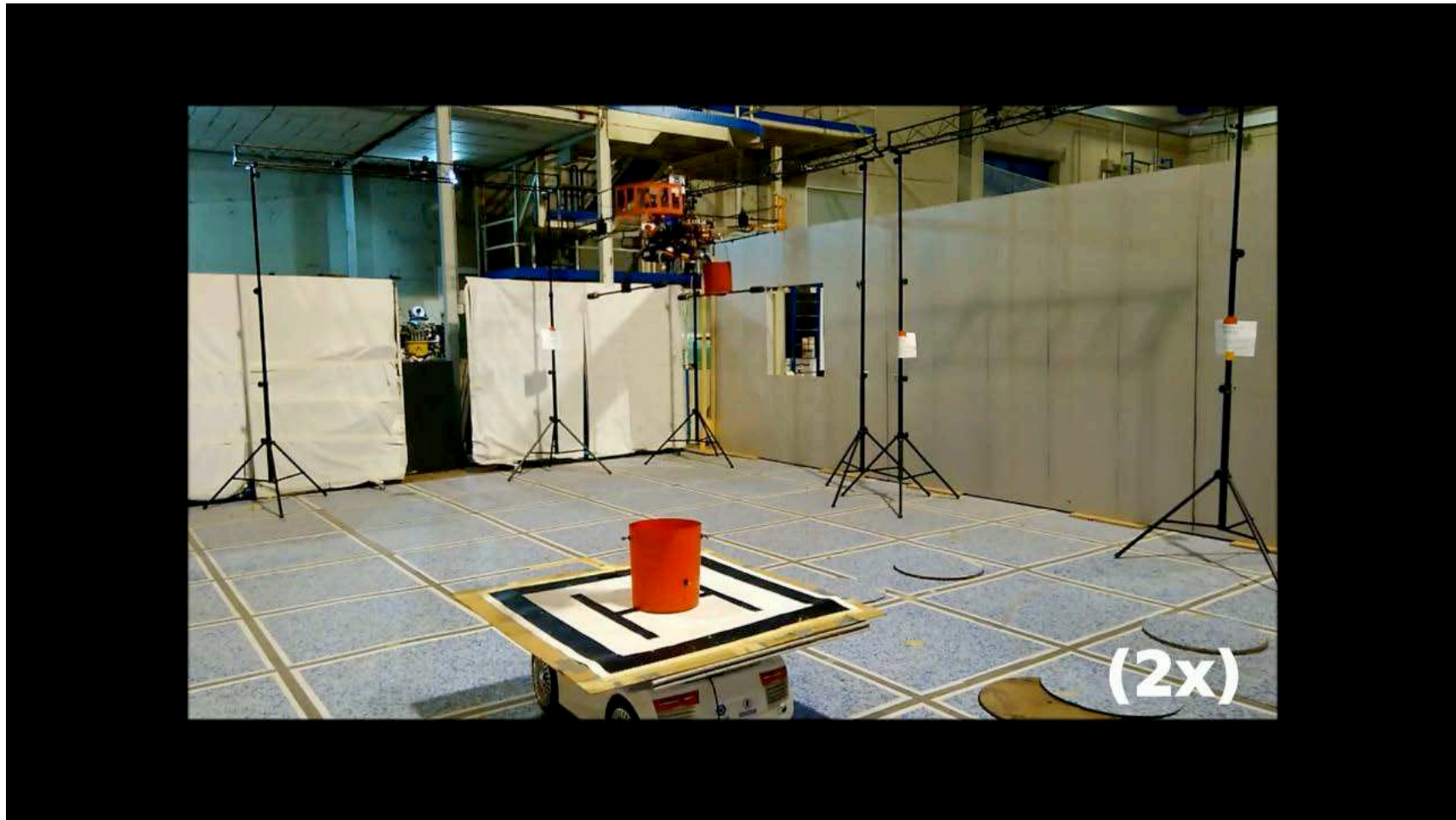


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2 Vision in Autonomous Flights:

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Dynamic Visual Servoing



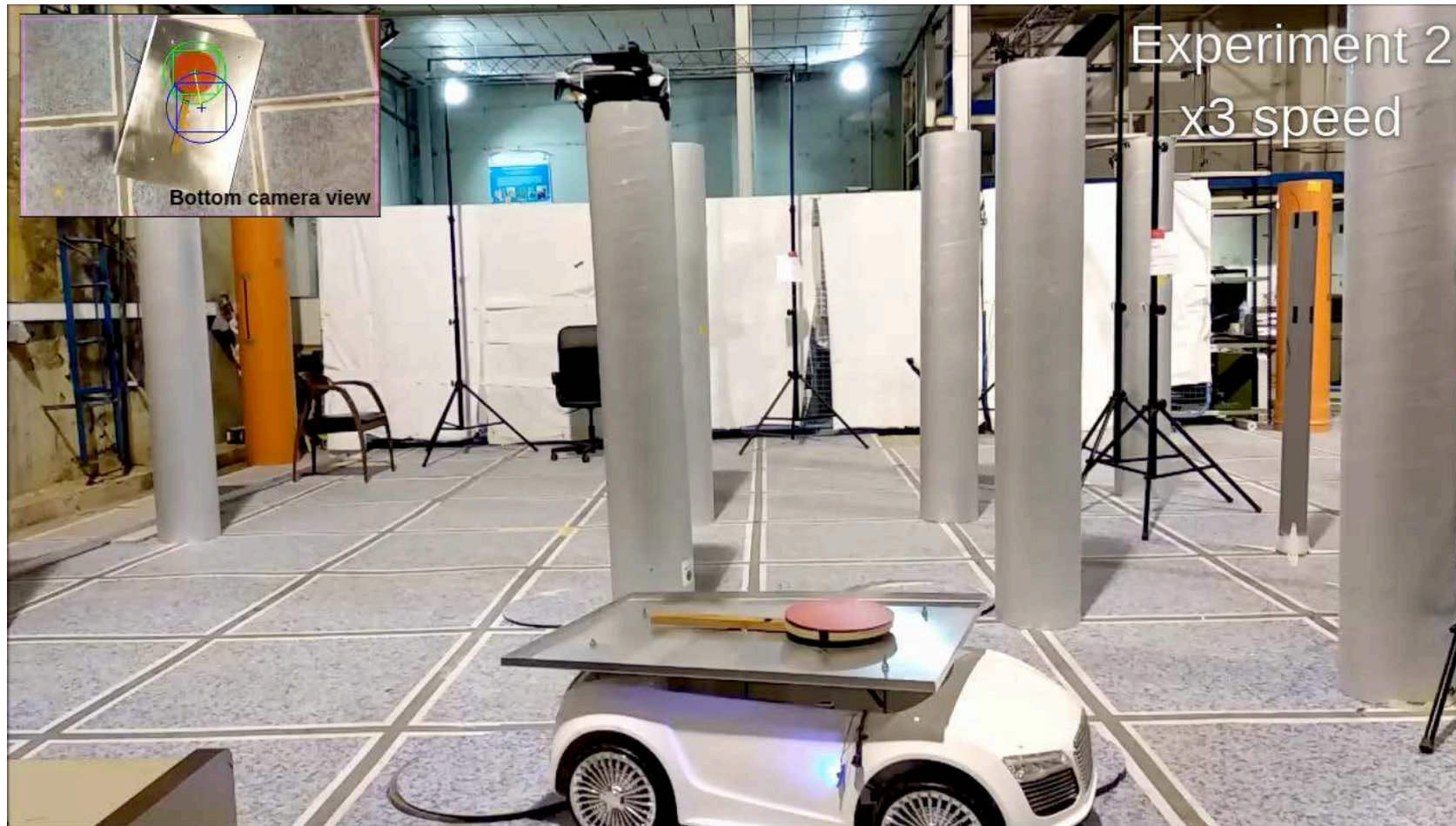
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2 Vision in Autonomous Flights: Image Visual Servoing by RL

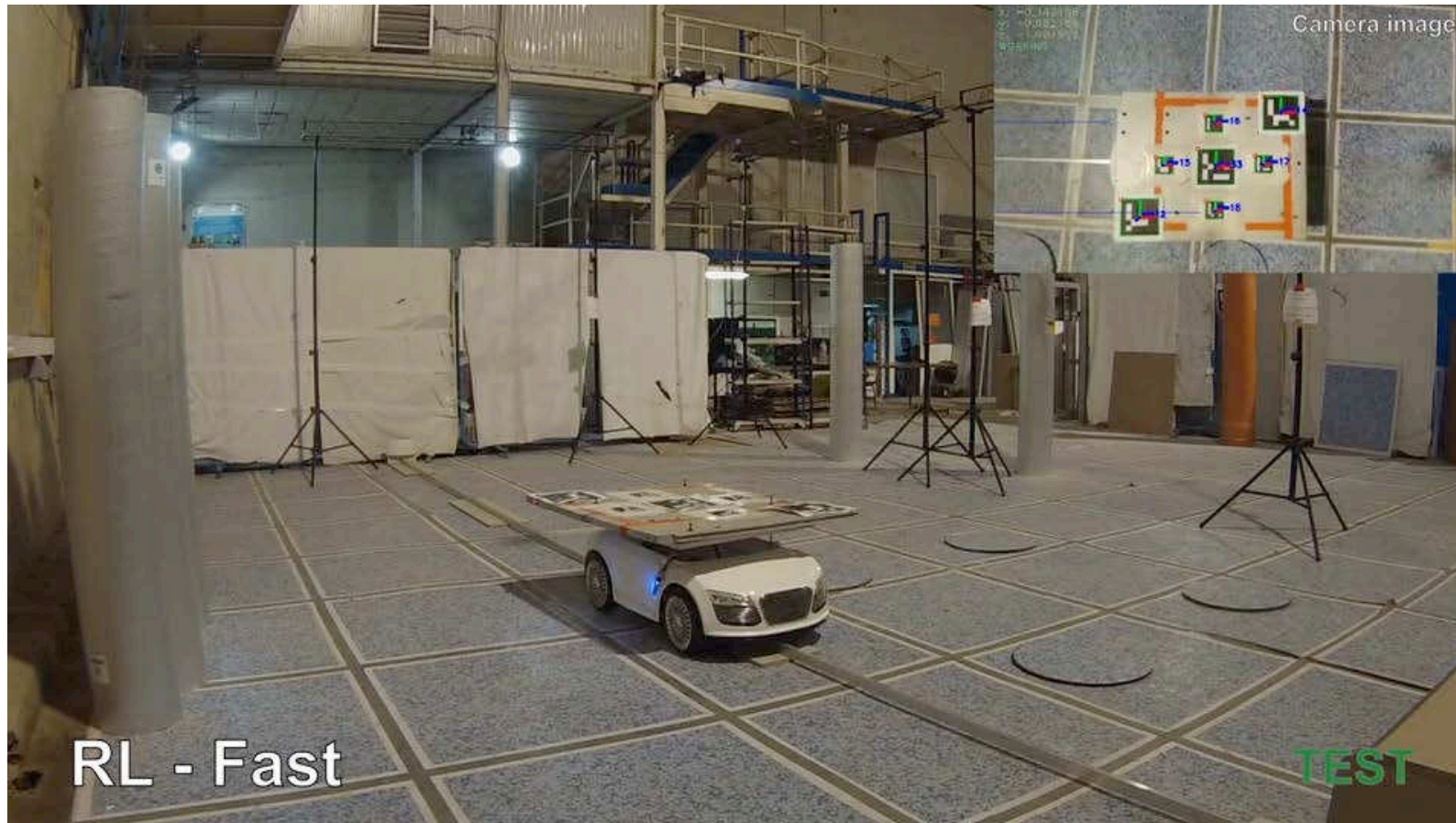
14



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“Image-Based Visual Servoing Controller for Multicopter Aerial Robots Using Deep Reinforcement Learning” by Carlos Sampedro et al. IROS 2018

2 Vision in Autonomous Flights: RL for visual autonomous landing

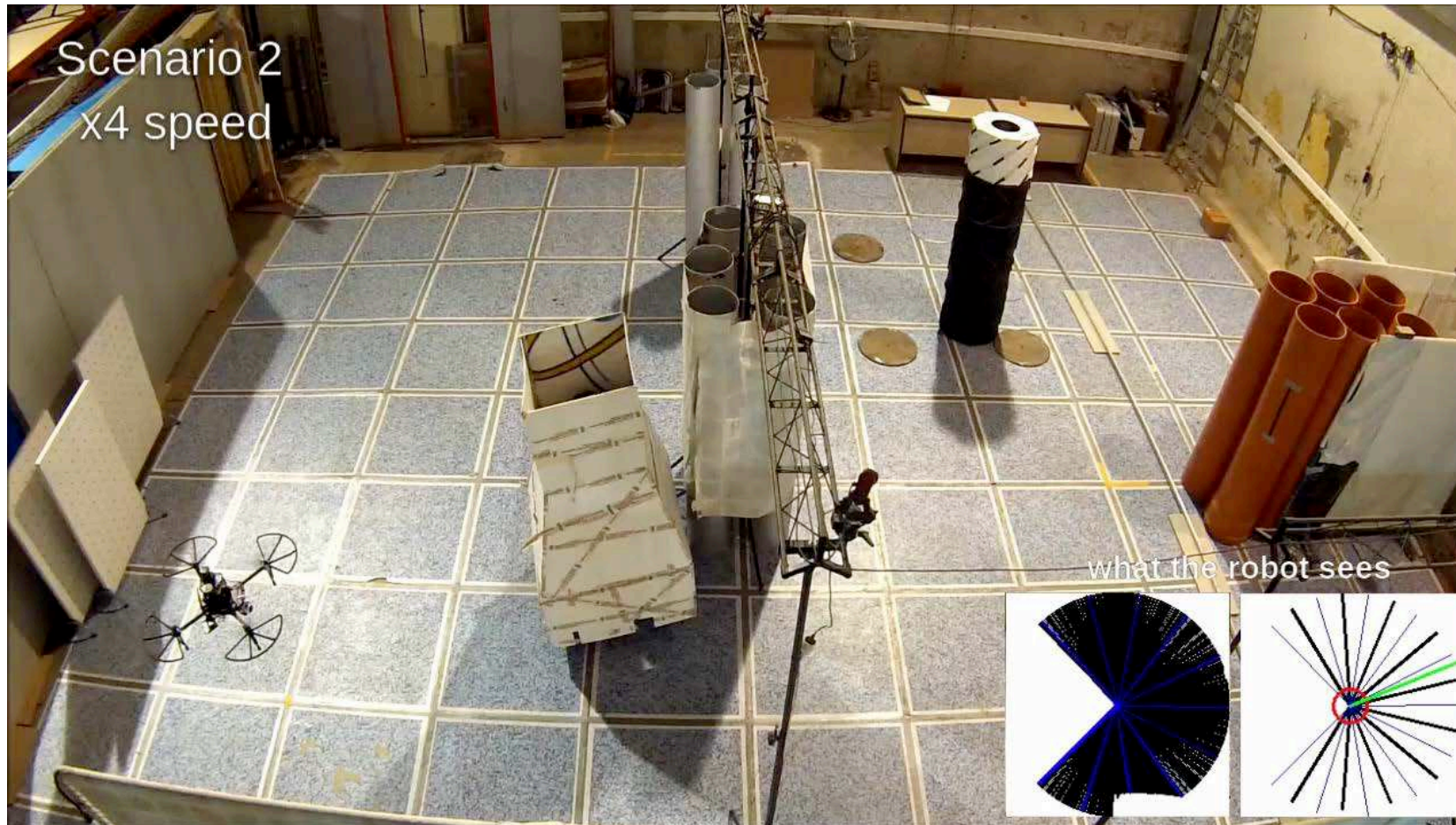




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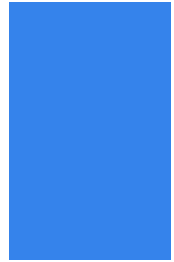
2 Vision in Autonomous Flights: Reactive Obstacle avoidance by RL

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“Laser-Based Reactive Navigation for Multirotor Aerial Robots Using Deep Reinforcement Learning” by Carlos Sampedro et al. at IROS 2018

2 Vision in Autonomous Flights: Drone detection by Learning



2 Vision in Autonomous Flights: Dynamic obstacle detection



**Dynamic object detection
for see&avoid
By DL from depth map
for project with M.I.T. (2018)**



2 Vision in Autonomous Flights: Dynamic obstacle detection

Detection Results - DJI Matrice (videos at 2x)



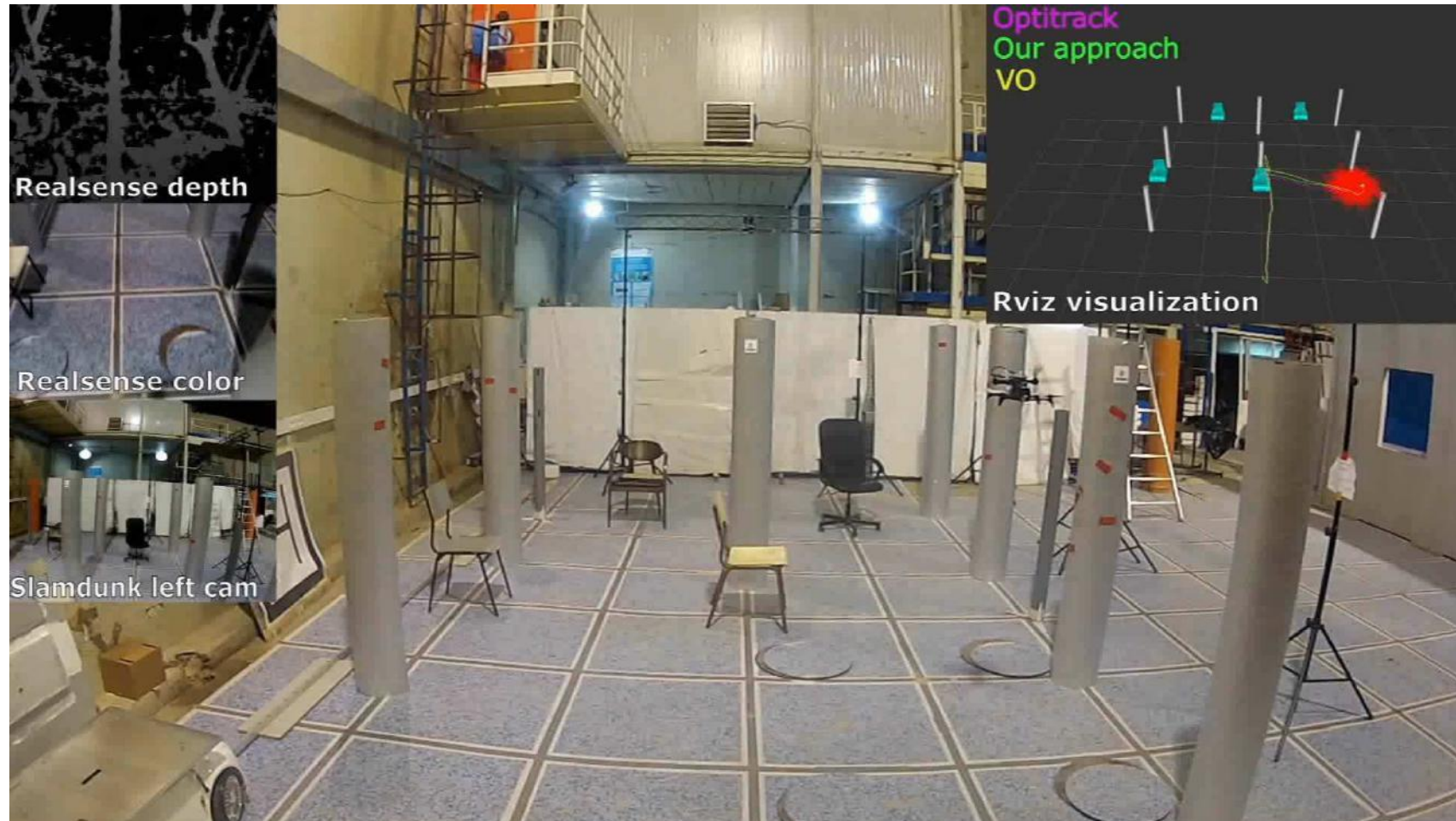
RGB view



Depth view

2 Vision in Autonomous Flights

Semantic SLAM



2 Vision in Autonomous Flights

Semantic SLAM



Semantic SLAM on-board Aerial
Robots using Planar Objects





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3D Laser on board UAV

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smartforce  **DAR**
Innovation for Aircraft Inspectio

**FASTER
MORE SECURE · MORE EFFICIENT**
TOTAL INTEGRATION FOR MAINTENANCE INSPECTION



Aircraft inspection for Airbus 2018-19



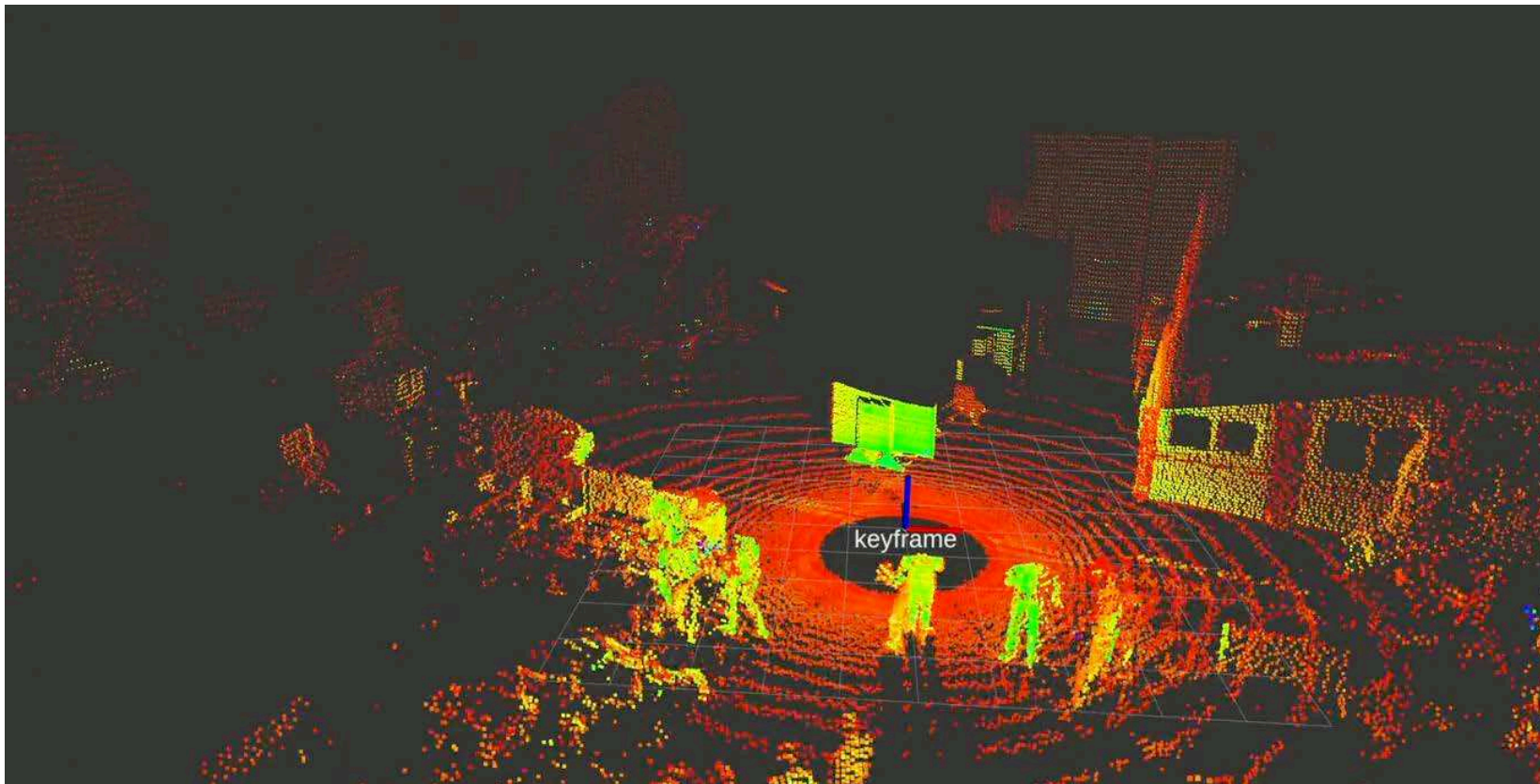


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3D Laser on board UAV

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Aircraft inspection for Airbus 2018-19



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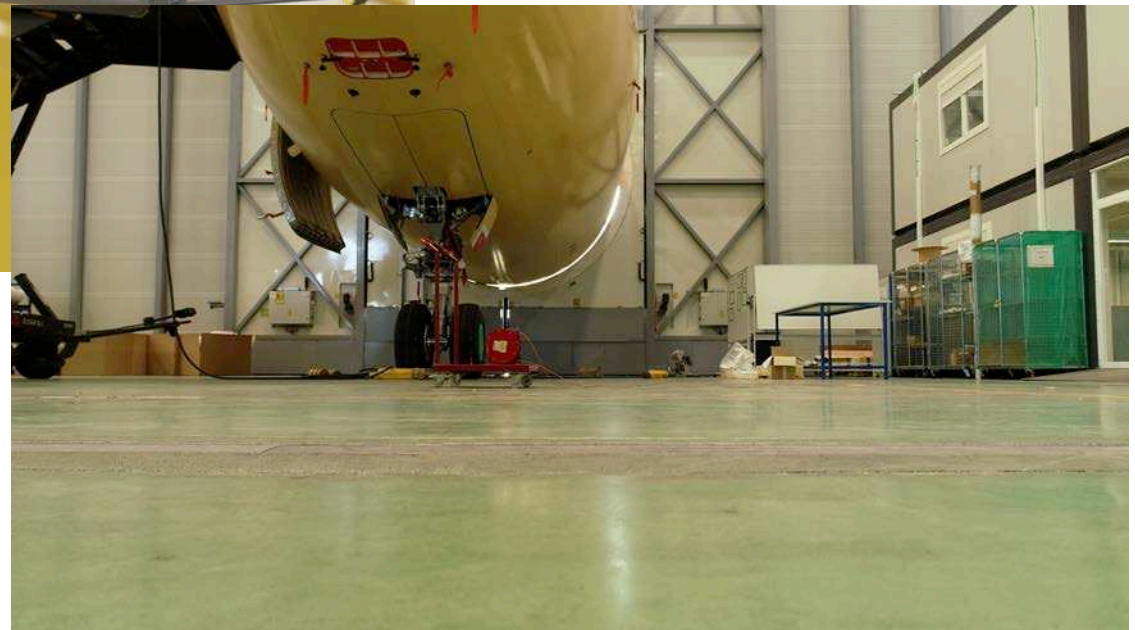


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3D Laser on board UAV

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Aircraft inspection for Airbus 2018-19



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3D Laser on board UAV

Aircraft inspection for Airbus 2018-19



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www.aerostack.org

AEROSTACK

A Software Framework for Aerial Robotic Systems



Version 2.1
Levant Distribution



Pages 53

Getting started

- What is Aerostack
- Install Aerostack
- Launch Real Flight
- License
- List of Distributions

Components

- Aerostack Architecture
- Graphical User Interface
- Mission Plan Languages
- Catalog of Behaviors
- Memory of Beliefs

Tutorials

- Execute Missions
- Program New Behaviors
- Add New Hardware
- Setup Communications

International competitions

- 1st prize at IMAV 2013
- 4th place at IMAV 2016
- 2nd prize at IMAV 2017

More information

- 1st version released July 2016
- 2nd version released September 2017
- 3rd version, ROSIN project April 2019



Vision for UAV: Own framework

Missions in Aerostack can be programmed:

- TML language
- Decision trees
- Python apps

```
import executive_engine_api as api

def runMission():
    api.executeBehavior('TAKE_OFF')

    api.activateBehavior('PAY_ATTENTION_TO_VISUAL_MARKERS')

    success, unification = api.consultBelief('position(self, (?x,?y,?z))')

    if success:
        x, y, z = unification['x'], unification['y'], unification['z'],
    else:
        print "Position unknown"

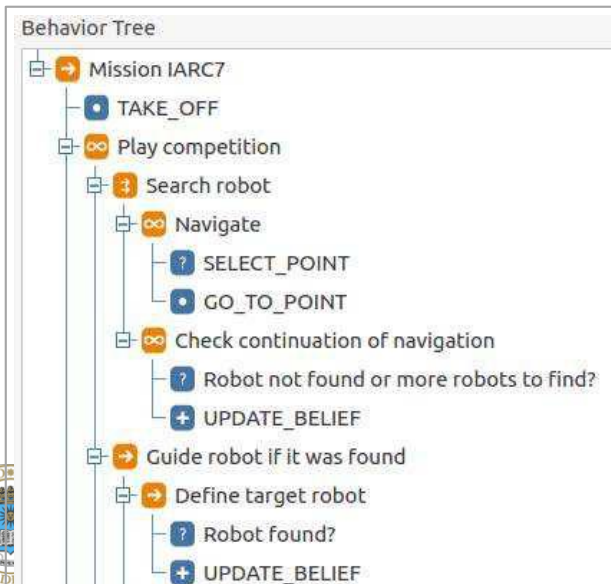
    api.executeBehavior('GO_TO_POINT',point=[2,5,1.3])

    api.executeBehavior('GO_TO_POINT',point=[x,y,z])

    api.inhibitBehavior('PAY_ATTENTION_TO_VISUAL_MARKERS')

    api.executeBehavior('LAND')
```

```
</task>
</task>
```

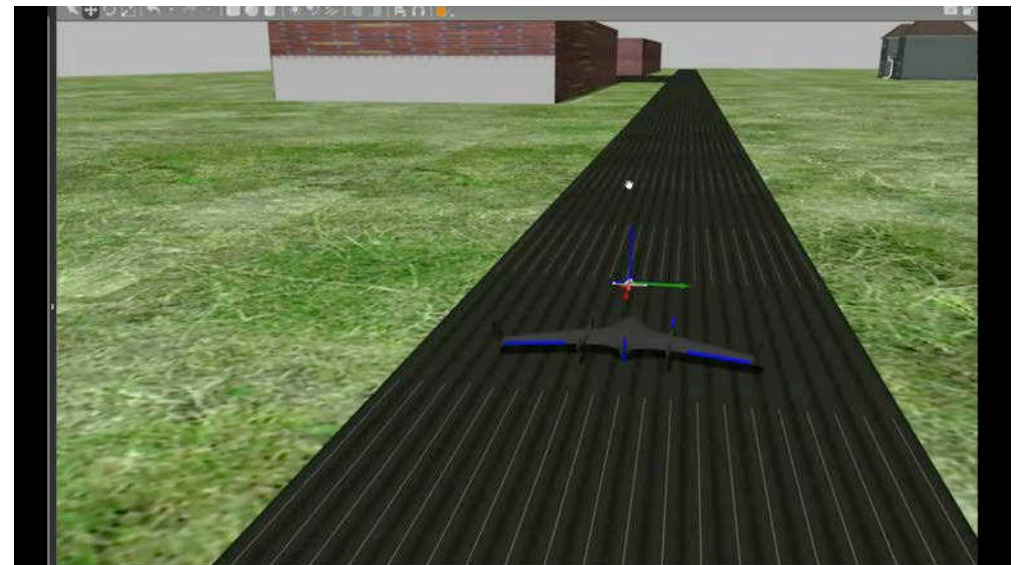


imav 2019

11th International Micro Air Vehicle Competition and Conference
30th September to 4th October 2019 in Madrid



imav 2019





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Visual inspection using drones:

Questions ?

