DIOL

Interreg North Sea

Co-funded by the European Union

WP2
SUSTAINABLE SOLUTIONS IN LOGISTIC HUBS´ INFRASTRUCTURE FACILITIES FOR NS GPPoE & ENERGY ISLANDS RENEWABLE ENERGY PROJECTS´ CONTRUCTION AND O&M IN THE NORTH SEA

WP2.2 DEFINE SPECIFICATIONS FOR SAFETY/SECURITY/SURVEILLANCE OF ENERGY INFRASTRUCTURE & PERIMETERS

DIOL will prepare the ground for introducing, piloting and validating use of surveillance, monitoring/inspection drones, robots and AI technology for security and maintenance of offshore Renewable Energy space/installations and connected logistic hubs´ areas specifically reserved for construction and O&M: design demo site, define requirements, allocate tasks, engage relevant stakeholders (e.g. Renewable Energy operators).

Pilot 6: Piloting inspection with testing UAV/UUV/robot/fencing for infrastructure security in 4 sites (Pilot 6.1: Esbjerg; Pilot 6.2: Ostend; Pilot 6.3: Rotterdam; Pilot 6.4: Brest)

Solution 6: Smart surveillance of Logistics Hubs / Renewable Energy infrastructure

PP6 VIVES Ground Robot for autonomous logistics hubs´ perimeters (Pilot 6.2)

1. EXECUTIVE SUMMARY

On July 2, 2025, a successful demonstration of a ground robot for perimeter inspection was conducted at Ostend-Bruges International Airport, Belgium, in the presence of local stakeholders.

Later, on October 15, 2025, during the DIOL partner meeting, the pilot results were presented and shared with all DIOL partners.

---

2. INTRODUCTION

As part of Work Package 2 – Sustainable Solutions in Logistics Hubs, DIOL is testing innovative technologies to enhance services for existing offshore wind farms and energy islands. This includes improving surveillance of energy infrastructure and perimeters in relevant ports and airports.

Specifically, DIOL is preparing the groundwork for introducing, piloting, and validating the use of drones, ground robots, and AI-based technologies for security, monitoring, and maintenance of offshore renewable energy installations and connected logistics hubs.

Within this scope, Pilot 6 involved perimeter inspection testing using a ground robot for infrastructure security at Ostend International Airport.

---

3. Pilot Overview

The VIVES Drone Applications Research Group, based at Drone Dock near Ostend-Bruges International Airport, was the logical choice for executing this pilot.

VIVES brings extensive expertise in operating autonomous aerial and ground systems. For the development of this prototype, VIVES collaborated closely with Zygo, a start-up specializing in

tailor-made autonomous solutions for robots and drones, including software, hardware, cloud services, prototyping, and end-to-end testing.

Traditionally, perimeter inspection at the airport is performed manually by personnel driving along the perimeter fence and visually checking its integrity. With today's technological advancements, this task can be automated.

To accelerate development, an existing platform was adapted for the prototype, with significant upgrades to both hardware and software. A key component was the fleet management software, enabling centralized control of multiple robots and over-the-air software updates.

The project also included creating a simulation environment of the airport, allowing the robot to train virtually rather than physically on the runway—significantly speeding up navigation algorithm development.

The underlying robot operating system is hardware-agnostic, ensuring easy transfer to other platforms.

During the demonstration at Drone Dock, a wheel-driven robotic dog was showcased as a production-ready alternative to the ground robot prototype.

For the live demonstration, the ground robot operated airside, scanning a section of the perimeter fence along a route currently inspected by a human in a vehicle.

---

4. DEMONSTRATIONS AND TECHNOLOGY HIGHLIGHTS

- **Capabilities:**
  - Fully autonomous navigation
  - Detect & avoid obstacles
  - Redundant wireless communication
- **Stakeholder Engagement:**
  - Presence of local stakeholders, including the airport CEO and mayor of Ostend.

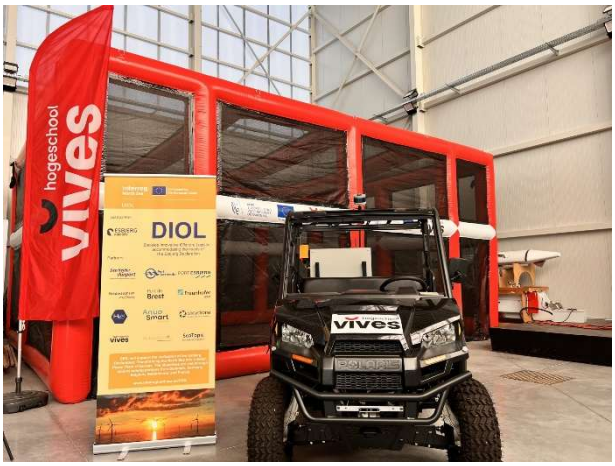
---

5. PROJECT CHALLENGES

- The existing sensors on the platform did not provide enough precision. Additional camera's needed to be purchased. Resulting in postponing the demonstration from March to July.
- The prototype is not weatherproof as consequence the demo had to be rescheduled
- Although extensive testing in a simulation environment, the navigation in a real live environment was less precise.

---

6. TECHNICAL SPECIFICATIONS



Hardware

- **Polaris Electric Vehicle**
  - Range: 70 km; Speed: 35 km/h.
  - Heavy-duty design resistant to sabotage.
- **Sensor Stack:**
  - GNSS RTK (2 cm accuracy via FLEPOS).
  - LiDAR for global planning and obstacle avoidance.
  - Depth camera for short-range obstacle detection.
  - 360° camera for comprehensive visual coverage.
- **Connectivity:**
  - 4G and LoRa networks.

Software

- **ROS2-based Setup**
  - Standard toolbox for robotics.
  - Microservice architecture: scalable, flexible, fault-tolerant.
- **On-device Intelligence**
  - No cloud dependency for decision-making.
- **Cloud Integration**
  - Fleet Manager with Over The Air (OTA) updates.
  - Data lake for AI-ready image processing.
  - Task Manager and real-time data connection.

---

7. MILESTONES

- **Simulation Setup**
  - Sensor noise modelling to minimize Sim2Real gap.
  - Finalize simulation and navigation systems for autonomous operations
- **Navigation**
  - Costmap-based routing.
  - Hybrid-A* path planning and predictive control.
- **Cloud Setup**
  - Fleet Manager, Data Lake, Task Manager, and front-end app.
- **Live Demonstration**
  - Conducted at International Airport Ostend-Bruges

---

8. PARTNERS AND ROLES

- **Pilot Leaders:** VIVES
- **Key Partners:** Zygo & International Airport Ostend-Bruges
- **Cooperating Partners:** all other DIOL PP (focus on those working in WP2.2)

---

9. CONCLUSIONS

The pilot demonstrated that autonomous systems are a viable alternative to traditional, human-based perimeter inspections—even for large sites such as airports and harbours.

Even without AI-driven breach detection, an autonomous vehicle can operate safely and capture remote imagery for inspection.

By collecting large datasets, these systems can be trained to automatically detect breaches and issue alerts, further enhancing security and efficiency.

---

9. Promotion

- Video: Interreg DIOL - Pilot 6
- DIOL website article: Vives unveils its autonomous ground robot at the presence of the Mayor of Ostend
- Linkedin: Vives post + Ostend-Bruges Airport post