Digital Technologies and their Importance for the Reconstruction of Ukraine

AutoDrone UA
Drone swarm-based autonomous Landmine Detection

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REBUILDING UKRAINE: NEW OPPORTUNITIES THROUGH DIGITAL TRANSFORMATION
HANNOVER APRIL 23, 2024

Bildquelle: https://www.atlanticcouncil.org/blogs/new-atlanticist/safe-distance-why-ukraine-should-embrace-land-mines/

Our Team

The Experts behind the AutoDrone UA Project

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Expert in digital logistics technologies

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Expert in explosive ordnance disposal and geophysicist

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Kharkiv Aviation Institute Ukraine

Expert in explosive ordnance disposal sensors

Deadly Danger even in Peace

Landmines claim more and more Civilian Victims

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Deadly Danger even in Peace

Remnants of War and Mines contaminate Areas for Decades

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Our Experience so far

Explosive Ordnance (EO) Detection for ferromagnetic Materials

Requirements

Systematic flight over rough terrain at constant low flight altitude < 1m with 2m wide metal detector system Magdrone R4.3

Objectives

Automated UAV flight for accurate detection of ferromagnetic materials such as EO's under ground, even in poor GNSS conditions.

Outcomes

Prototype for automatic flight of rough terrain using additional 3D sensor technology for highly accurate terrain scans in realtime

Project AutoDrone 2021 - 2023

- 3D Lidar based predictive flight control for accurate, smooth and safety flight under poor sight- and GNSS conditions
- Efficient automatic area scans for the detection of EOs with 1-2 cm accuracy in rough terrain
- Data fusion of position and scan data with low latency
- Avoiding obstacles

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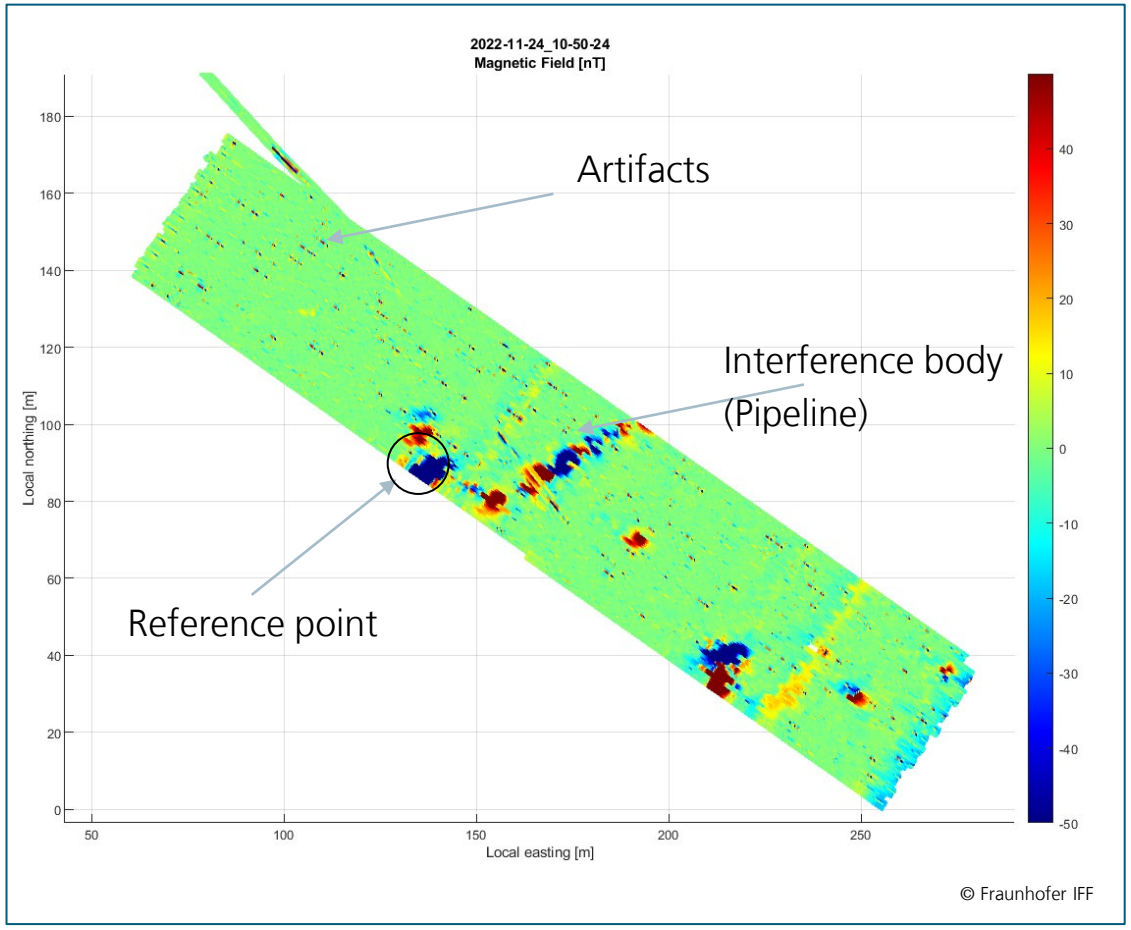
First Flight Tests



Remaining Tasks:

- Remove jerks
- increase speed
- RTH (Return to home) scenario change battery – optimize pause/resume behavior

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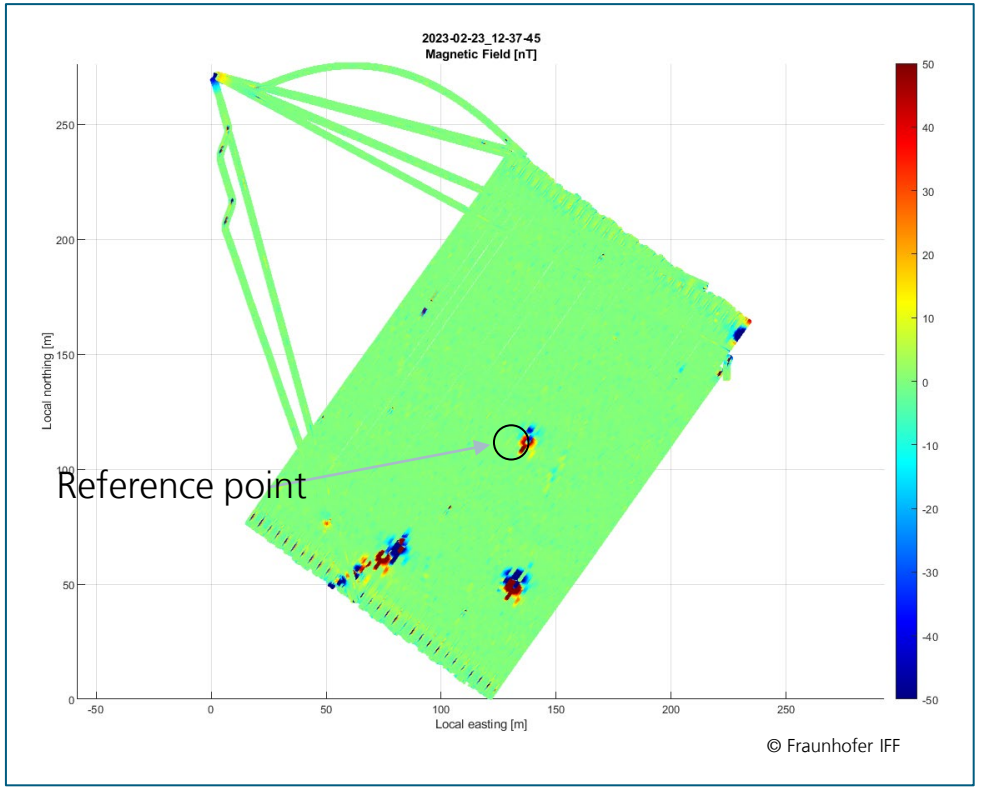
Continued real Tests with optimized Flight Control



Remaining tasks:

- Latency optimization

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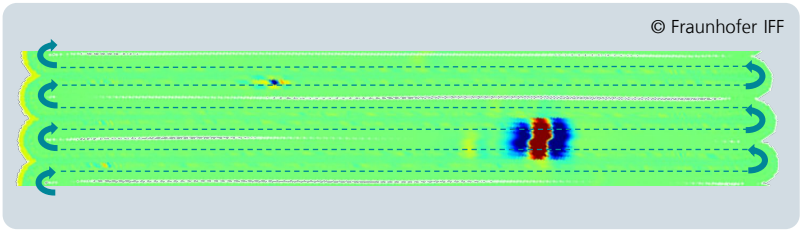
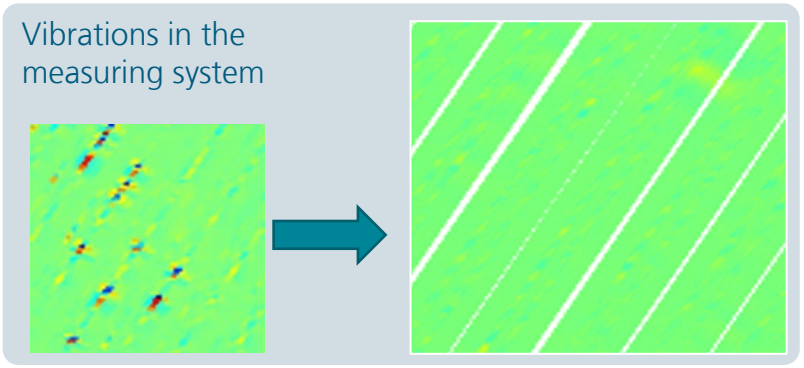
Current State - precisly Flight Planning and –execution

- ✓ Constant low flight altitude (50 cm)
- ✓ Low vibration at high flight speed (3m/s → 5 m/s)
- ✓ High temporal synchronization of the measurement data between sensors





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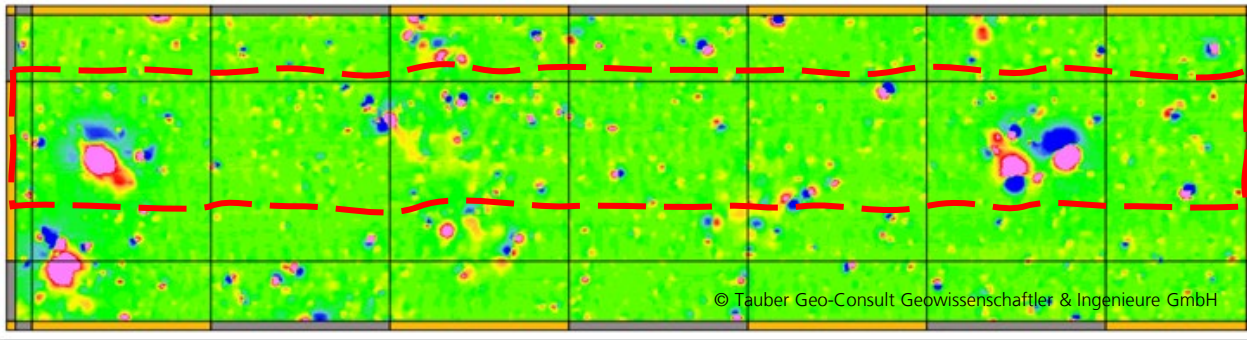
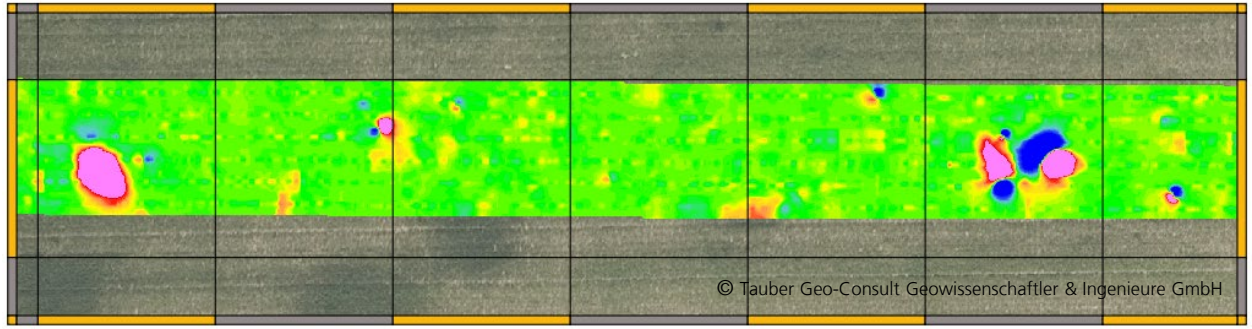
Comparison between ground-guided Movement and automated Drone Flight



State of the art: Ground-guided manual movement with a handcart

Advantages of an automated drone flight:

- ✓ Fewer artifacts due to smoother motion control of the magnetometer sensor
- ✓ higher scanning speed



AutoDrone: Automatic flight with a drone

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From a safe distance: Autonomous drones for exploring the terrain and detecting remnants of war

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The Variety of EOs and Sensors

Thermal camera	Detection of non magnetic EOs close to the ground surface
NLJD (Non Linear Junction Detection)	Detection of EO made of plastic with low or less magnetic content
multi- and hyperspectral camera	Detection of anomalies and EOs
GPR (Ground Penetrating Radar)	Detection of EO made of plastic with low or less magnetic content
Magnetic field sensor	Detection of artellery ammunition

Different types of EO:

- **anti-tank mines**
- **anti-personnel mines**
- hand-held anti-personnel grenades
- hand-held anti-tank grenades
- artillery ammunition

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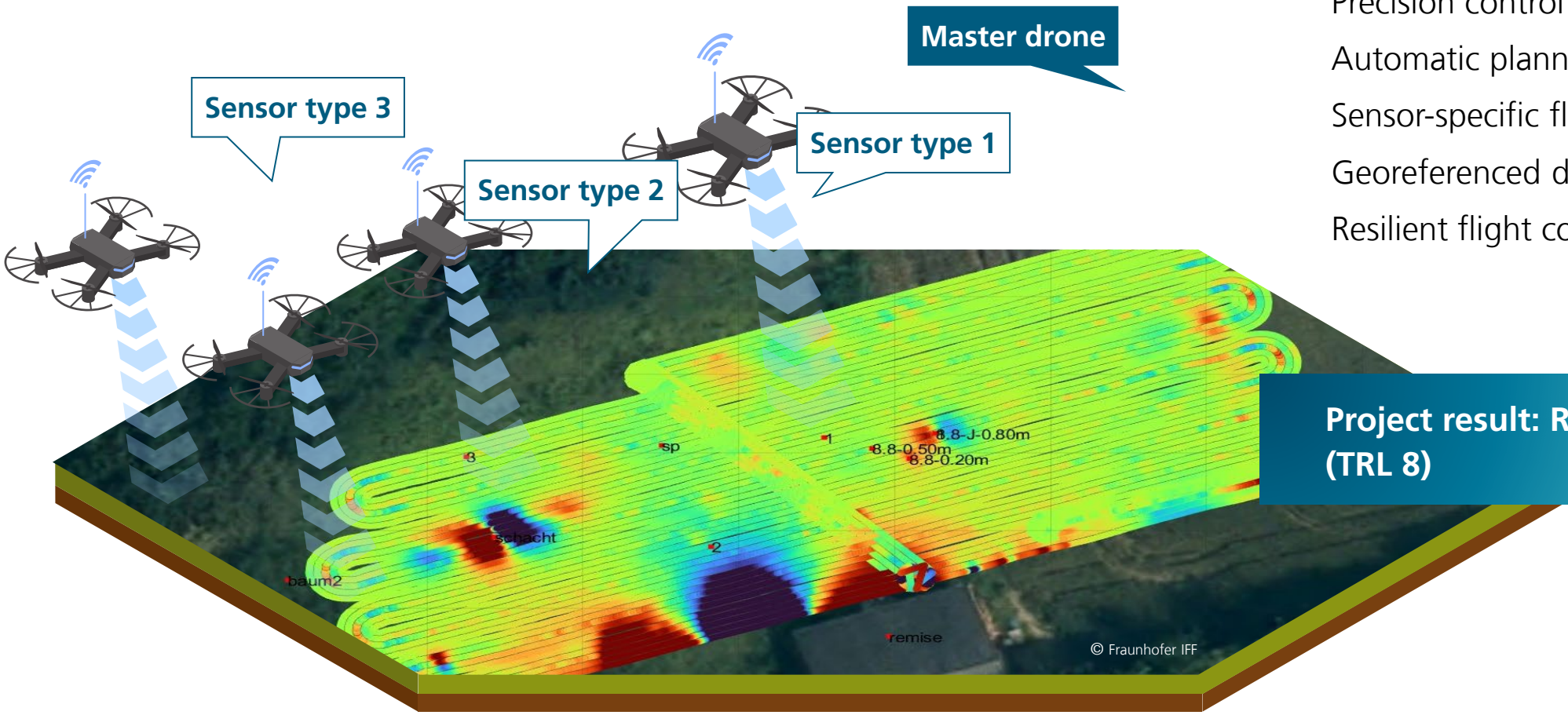
Our technical Solution



Initial situation:

Precision control for the single drone (TRL 6)

Automatic planning of the swarm mission

Sensor-specific flight path planning

Georeferenced data processing and analysis

Resilient flight communication

Project result: Resilient drone swarm (TRL 8)

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AutoDrone Swarm Network Control

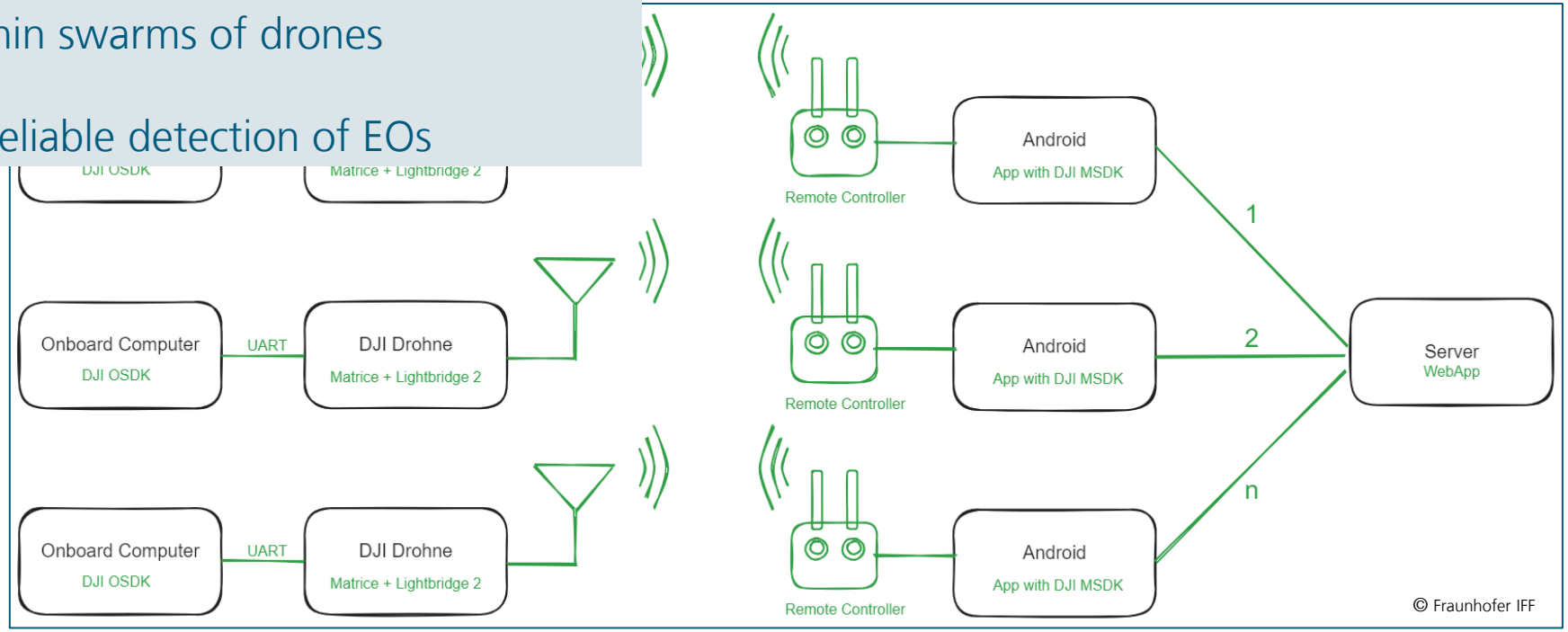
Just one manager for the entire swarm system

One Solution for all automated swarm-based detection tasks

High level secured flight control in swarm

Advanced obstacle avoidance within swarms of drones

Quality-assured flight control for reliable detection of EOs



Let's shape the future together
- ON SAFE GROUND -

Support our AutoDrone UA project!

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