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Monitoring Tourist Flows with Drones at the Varna Pilot in Bulgaria

TOURISMO Final Conference
Valletta, Malta | 9 June 2026

Varna Economic Development Agency

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Project: TOURISMO (Euro-MED Programme)

Pilot Lead: Varna Economic Development Agency

Location: Varna, Bulgaria

Objective: To test innovative digital technologies for monitoring tourist flows and to supporting evidence-based tourism management through UAV monitoring, thermal imaging, and smart-city data integration.

Pilot Locations:

- Independence Square
- Sea Station Area
- Sea Garden Entrance



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Varna Pilot at a Glance

Local Challenges

Varna is one of Bulgaria's leading tourism destinations and experiences:

- ✓ Seasonal concentration of visitors
- ✓ High pedestrian traffic in key urban areas
- ✓ Accessibility and mobility challenges
- ✓ Conflicts between pedestrians and micro-mobility users
- ✓ Climate-related impacts on visitor comfort
- ✓ Need for evidence-based tourism management



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Why Monitor Tourist Flows?

Key Question

How can innovative technologies help us better understand visitor behaviour and improve destination management?



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Why Monitor Tourist Flows?

What Did We Want to Achieve?

The Varna Pilot aimed to:

- ✓ Monitor tourist flows in key urban locations
- ✓ Analyse visitor movement patterns
- ✓ Assess accessibility and mobility conditions
- ✓ Evaluate the influence of environmental factors
- ✓ Integrate data into the Snap4City platform
- ✓ Support sustainable tourism management and decision-making



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Pilot Objectives

Data Collection Approach

Unmanned Aerial Vehicle (UAV) Monitoring

Drone equipped with:

- High-resolution optical cameras
- Thermal radiometric camera

Additional Sources

- Ground observations
- Photographic documentation
- Existing tourism and mobility information



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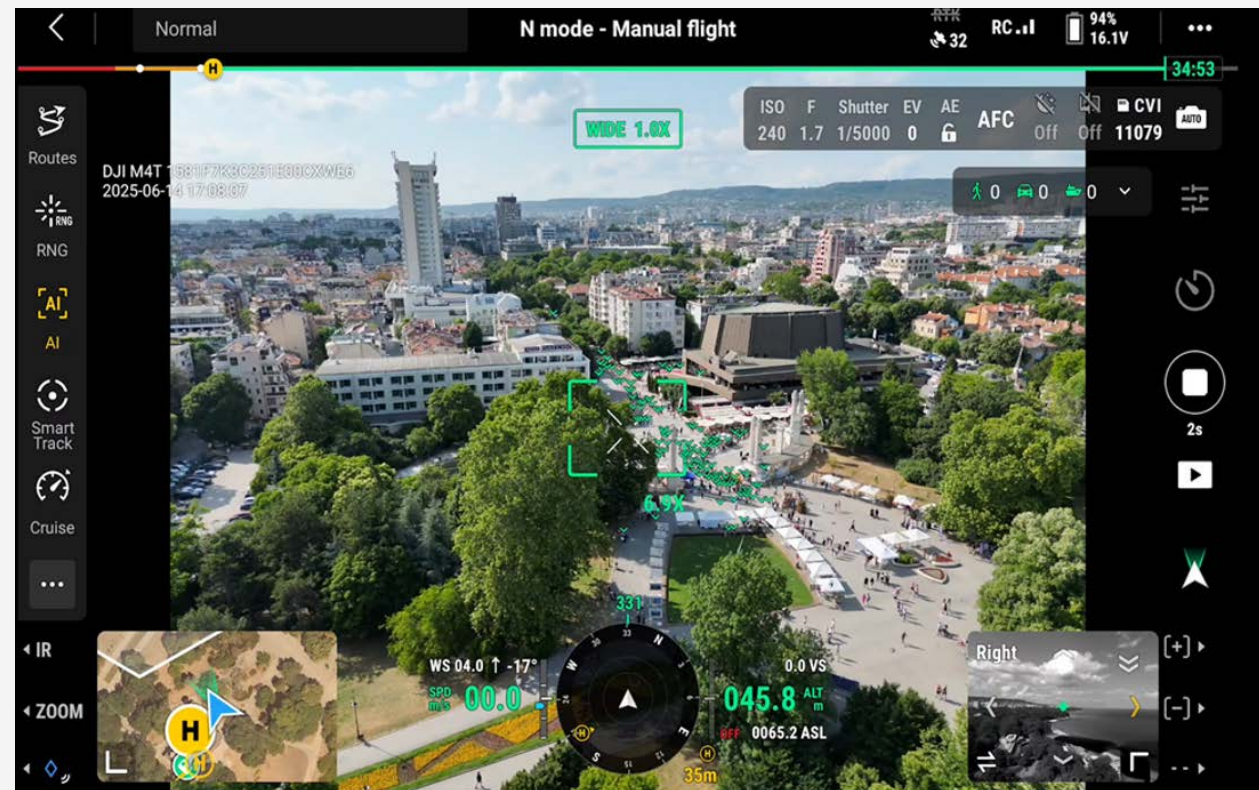
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Monitoring Methodology

Data Collection Approach

Benefits

- Non-intrusive monitoring
- Large area coverage
- High spatial accuracy
- Simultaneous visual and thermal analysis



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Monitoring Methodology

Three Strategic Tourism Hotspots

✓ Independence Square

Historic city centre and mobility hub

✓ Sea Station Area

Waterfront and port-related tourism zone

✓ Sea Garden Entrance

Main gateway to Varna's largest recreational area

Why these locations?

- High visitor activity
- Diverse mobility patterns
- Different infrastructure characteristics
- Representative tourism environments



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Pilot Locations



Three Strategic Tourism Hotspots



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Pilot Locations

From Drone Images to Smart Data

Monitoring flights generated:

- Visual imagery
- Thermal imagery
- Visitor flow observations

Data were:

- Processed using specialised software
- Aggregated into datasets
- Structured and translated into English
- Integrated into the Snap4City platform

Cooperation with UNIFI

University of Florence supported data ingestion, transformation, storage, and visualisation processes.



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Data Processing & Integration

Key Findings

Visitor Behaviour

- Visitors consistently preferred shaded routes
- Areas with seating and refreshments attracted longer stays
- Tourist flows shifted according to comfort conditions

Thermal Conditions

- Processed using specialised software
- Surface temperatures reached up to 55°C
- Thermal comfort strongly influenced movement patterns

Mobility

- Continued presence of bicycles and scooters in pedestrian zones
- Mixed-use traffic created potential safety conflicts



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What Did the Data Reveal?

Challenges Identified

Independence Square

- Limited nearby refreshment points
- Lack of tourist parking
- No dedicated bicycle infrastructure

Sea Station Area

- Accessibility issues due to uneven surfaces
- Fragmented pedestrian routes
- Reduced attractiveness of some commercial areas

Sea Garden Entrance

- Parking pressure
- Temporary installations affecting circulation
- Shared-use conflicts between pedestrians and cyclists



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Infrastructure & Accessibility Insights

Challenges Identified

Lessons from Implementation

- GPS interference, UAV jamming & spoofing
- Regulatory requirements for UAV flights
- Permissions for operation near the Port

Additional Insights

Thermal imaging provided valuable information beyond visitor counting by revealing how climate conditions affect tourism behaviour and public-space use.



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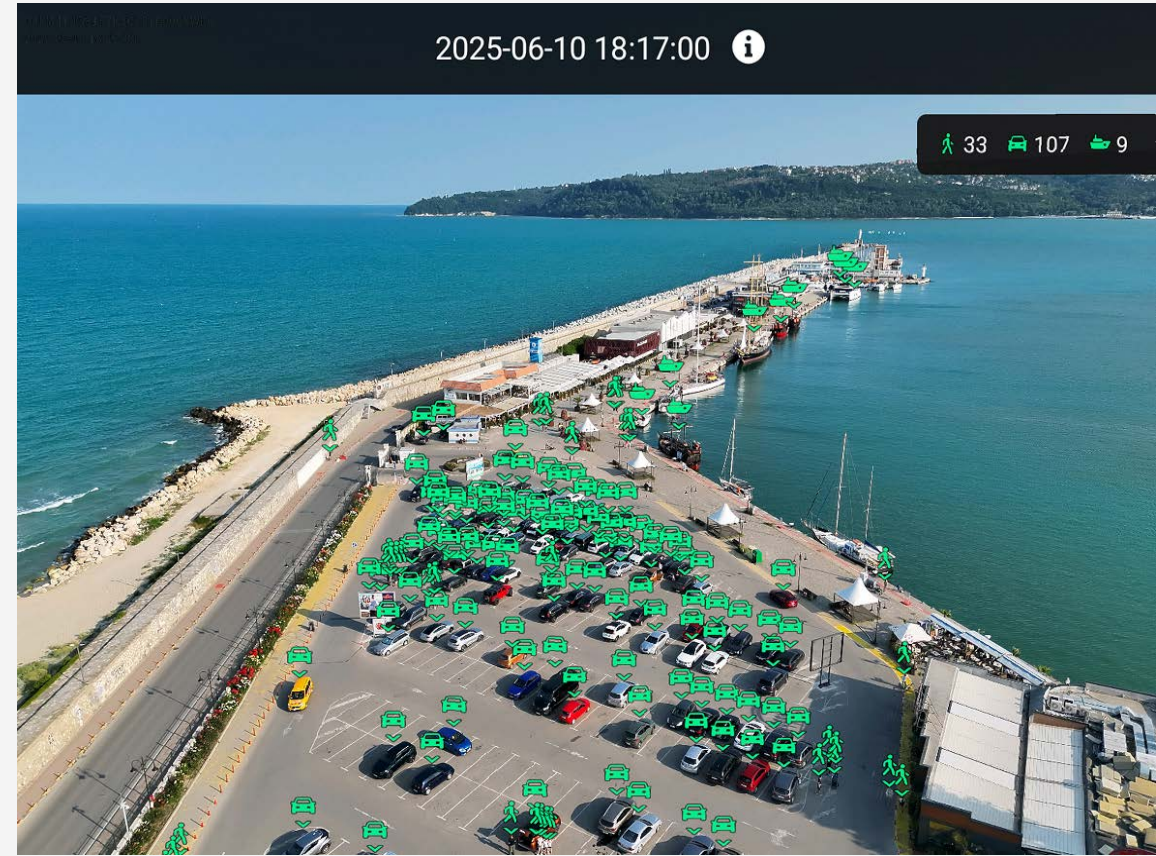
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Unexpected Findings & Challenges

Supporting Evidence-Based Tourism Management

Pilot results can support:

- ✓ Visitor flow management
- ✓ Urban planning
- ✓ Sustainable mobility policies
- ✓ Accessibility improvements
- ✓ Climate adaptation measures
- ✓ Public-space design
- ✓ Tourism infrastructure investments



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Value for Decision-Makers

Sustainability and Future Applications

Continued Use of Methodology

- Future tourism monitoring activities
- Smart-city and GIS integration
- Decision-support tools

Capacity Building

New UAV educational specialty launched in 2026 in Varna at High School "Academic Bl. Sendov"

New Applications

Euro-MED IDRON Project:

- Soil moisture monitoring
- Water source identification
- Natura 2000 & forest management



Bulgaria

Optimizing Irrigation Plans Using Drone Data

Use of UAV technology to collect soil-moisture and vegetation data to support efficient irrigation planning.

<https://idron.interreg-euro-med.eu/>



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Beyond TOURISMO

Key Takeaways

- ✓ UAV monitoring provides reliable and scalable tourism intelligence
- ✓ Combining visual and thermal data improves understanding of visitor behaviour
- ✓ Data-driven approaches support smarter crowd-flow management
- ✓ Smart-city platforms facilitate analysis and decision-making
- ✓ The Varna Pilot demonstrates a transferable model for sustainable tourism management in Mediterranean destinations



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Conclusions



Thank You!

Todorka Dimitrova

Varna Economic Development Agency

www.veda-bg.eu

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Making
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