Applications for the 5G-era and beyond

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25th Infocom World Conference
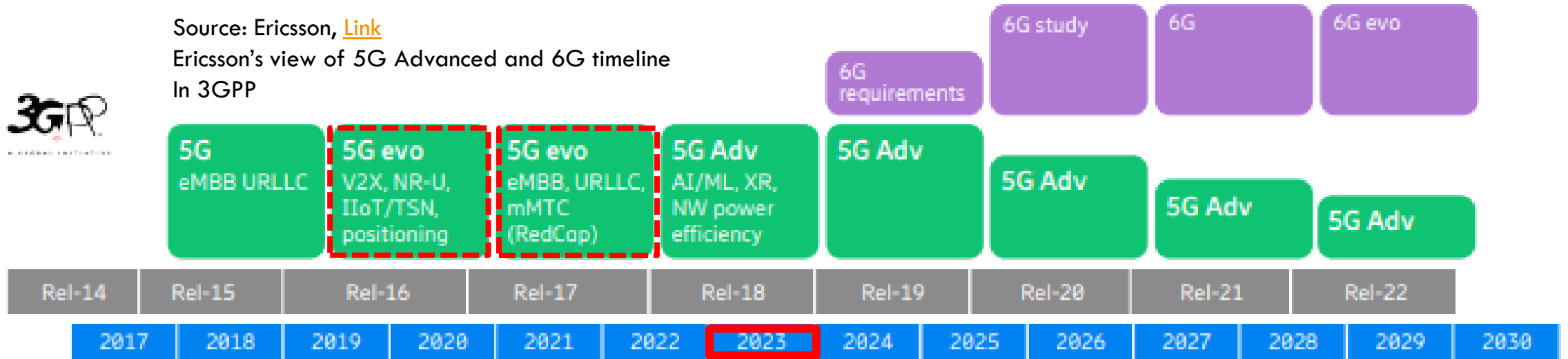Athens, December 14, 2023

Overview

Wireless **Infrastructures** Status and Evolution

Applications (benefitting from 5G)

Beyond 5G towards **6G**

Wireless Infrastructure Status and Evolution

Infrastructure status / evolution overview

Source: Ericsson, Link
Ericsson's view of 5G Advanced and 6G timeline
In 3GPP

Powerful foundation.

Early **5G NSA** network deployments, consumers,
faster speeds, higher data rates through enhanced mobile broadband (**eMBB**),
as well as Internet of Things (**IoT**), …

5G SA: **Critical IoT** (milli-second latency / URLLC), **Massive IoT** (1 million per sq. km),

Ref.: Deloitte: Link; Nokia: Link; and many more

Applications – key to the success

Application Groups (WINGS ICT Solutions Approach)
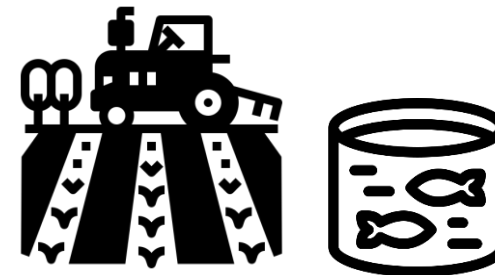

A. Environment Protection

B. Industry & Logistics

C. Smart Cities

Infrastructure, Buildings, Water, Energy,

Health / Wellness

D. Agriculture / Aquaculture

12/14/2023

Technology Foundation

IoT: Devices, (far-)edge intelligence

5G: complemented by other networks

AI: Machine learning, decision support

VR: Visualizations, dashboards, applications

A. Environment Protection: Wildfires: AIRWINGSplus

**Direction**: Enhance prevention / detection through IoT + wireless + AI

Range: up to 10 Km

Connectivity
(4G, 5G, beyond)

AIRWINGS plus

US Patent Application.
Title: AUTOMATED SYSTEM AND METHOD FOR FIRE DETECTION
Serial No: 18/379,123 (Ref: 15076-01328US)
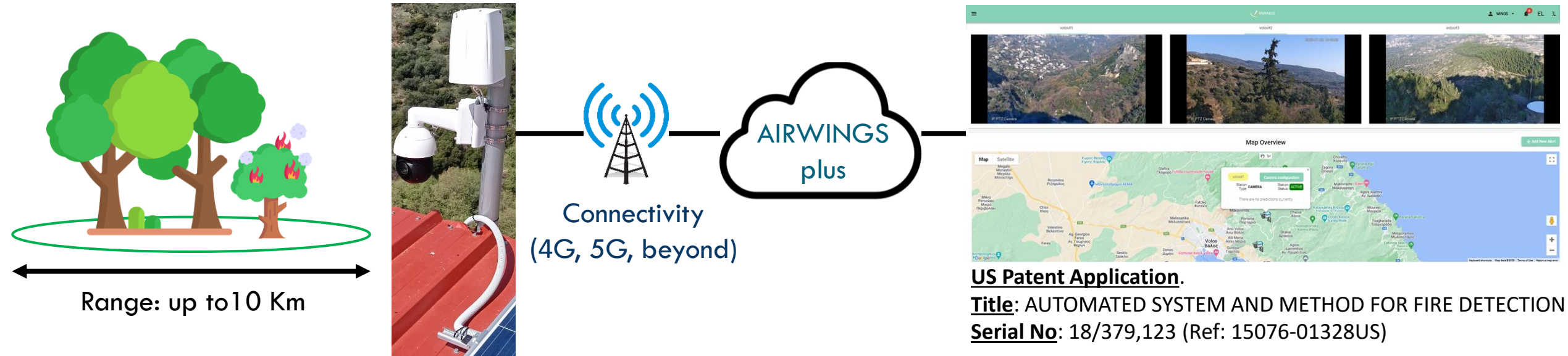
Edge Devices

- ☐ Cameras
- ☐ AIRWINGS devices
- ☐ WINGS gateway

Functionality

1. Monitoring
2. Autonomous fire detection through AI / video analytics (patent by WINGS)
3. Warnings to operator and authorities

A. Environment Protection: Wildfires: Installations

IP PTZ Camera
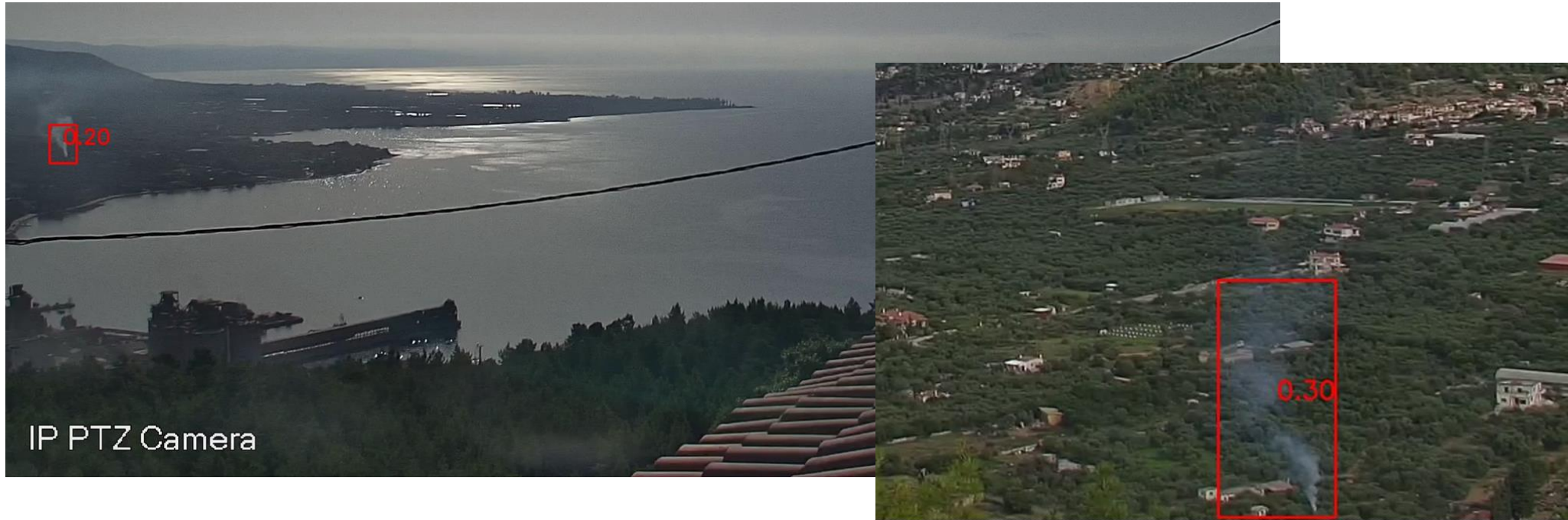
1. Integration with Diverse Cameras – Multiple Sensors
2. Explainable AI-based Early Danger Detection
3. Robust System Validated in the Field with Real Data (2 extended installations) / Demonstrations and Pilots ongoing
4. Flexibility in installations

A. Environment Protection: Pilot: East Attika
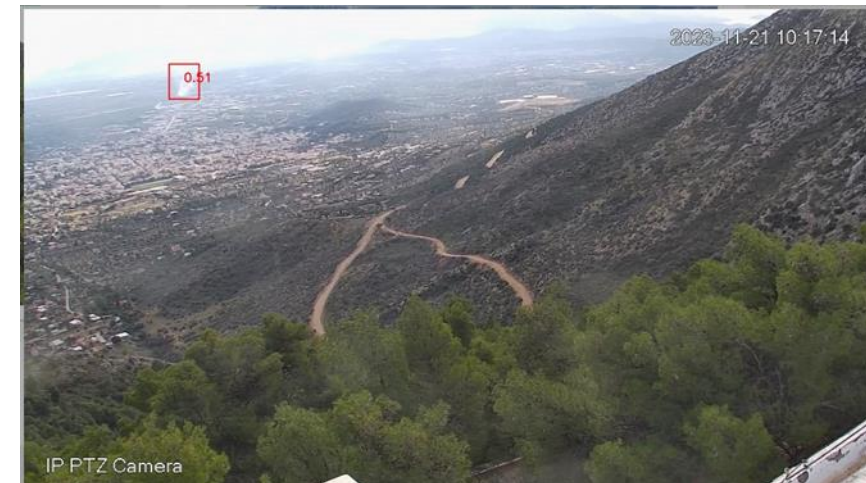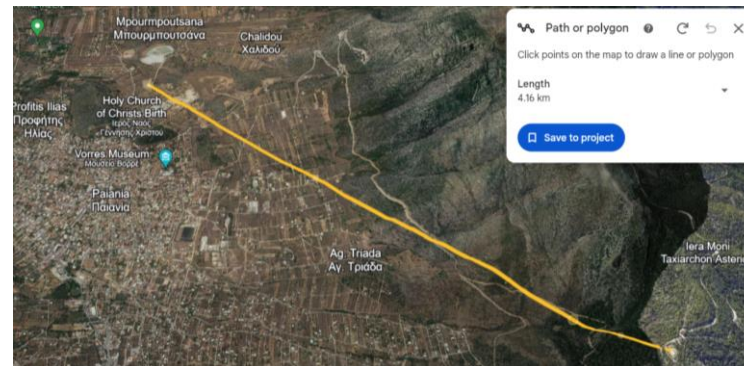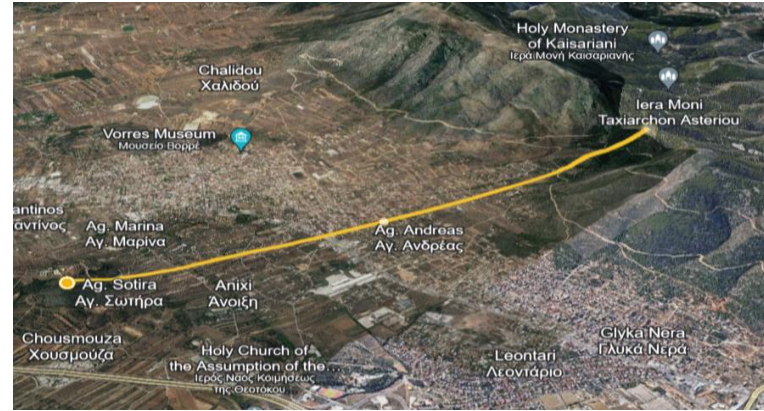
Distance: 4600 / 4000 m

A. Environment Protection: Pilot: North Attika
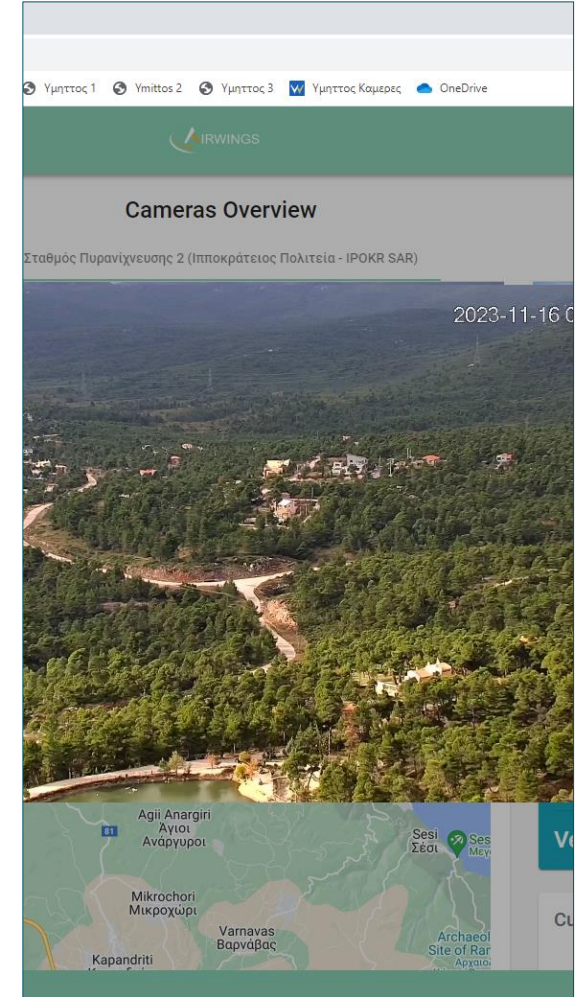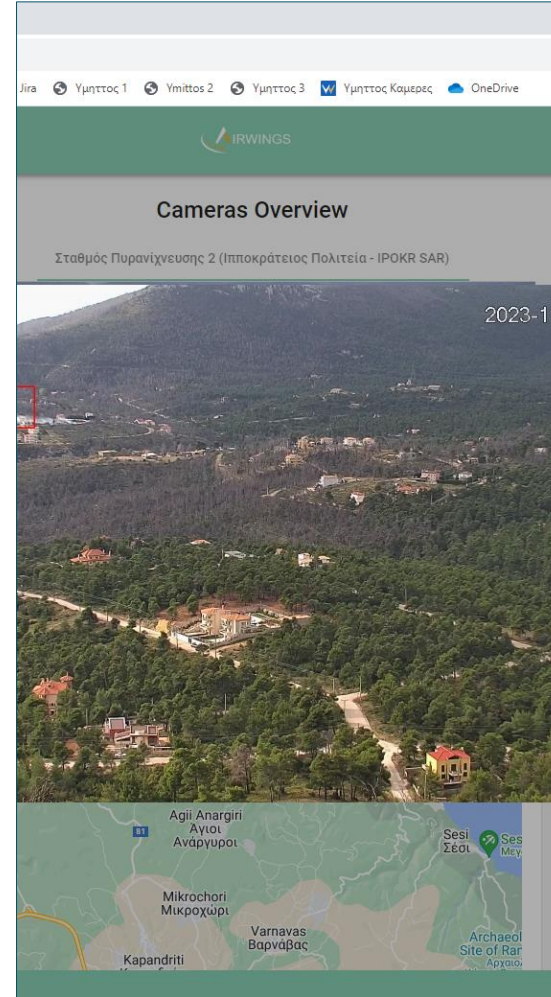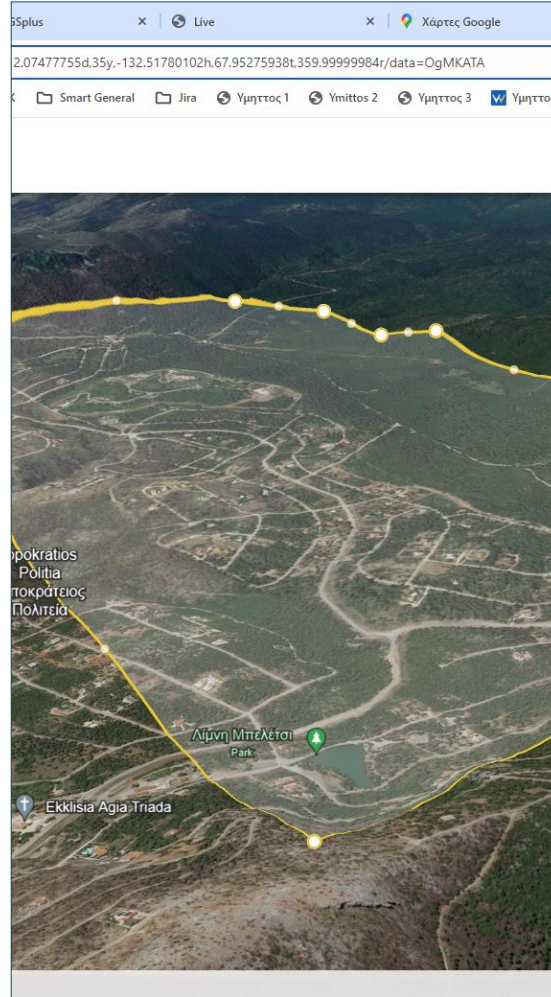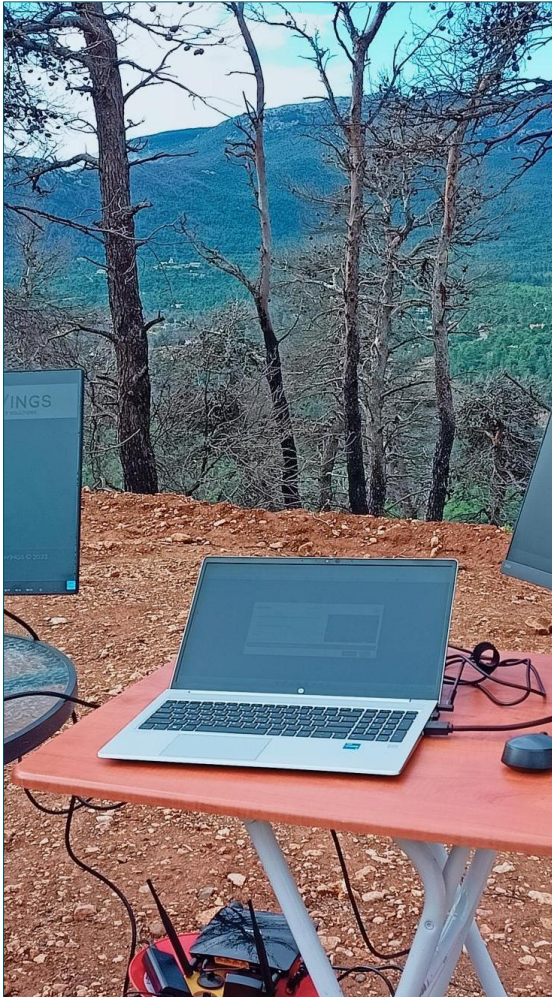
B. WINGS Approach to Industry and Logistics

Product: WINGSChariot/ **WINGSFactory**: product for serving the needs of the logistics and manufacturing (industry 4.0) industries

Technology: Leveraging on **IoT** / **robotics**, advanced networks (predominantly 5G and beyond), **AI**, **XR**

Benefits: human resource advances, energy, productivity (units prepared or transferred per time-period), quality

B. WINGSChariot / WINGSFactory: scope

Area	Logistics Warehouse	Logistics Transfer	Manufacturing Plant / Industry
Targeted Function	Move Goods to Storage. Order Management. Shipping.	Goods Transfer Conditions. Vehicle Status. Driver Aspects.	Raw Material Movements. Assembly. Processes. Quality Assessment, Product Shipping.
Technology	**Robotics**, 5G (Campus), **IoT, AI**. Legacy: Warehouse Management Systems.	**OBU** (On Board processing Unit), 5G (corridors), **IoT, AI**. Legacy: Fleet management	**Video Analytics, Robotics, IoT, AI**, 5G (Campus). Legacy: SCADA. PLCs. OPC-UA. Automations.
Benefits	Workforce transformation, Productivity, Worker safety, Product safety, …	24/7 Monitoring, Driver safety / assistance, Vehicle safety / insurance	Productivity. Energy optimization. Resource optimization. Worker Safety.

B. Industry & Logistics: Warehouse: "Follow-me"

Order Management:
AMR follows worker and assists in the order formation.
AMR carries the order
When order is fixed, it is transferred to the *checking* and then to the *shipping* area.
Further automations are underway

Live Demos:
OTE Academy
or at
WINGS Premises

B. Industry & Logistics: On-street

Overview of current shipments conditions

Vehicle's shipment detailed conditions, route and current location

Live Alerts and Historic Data
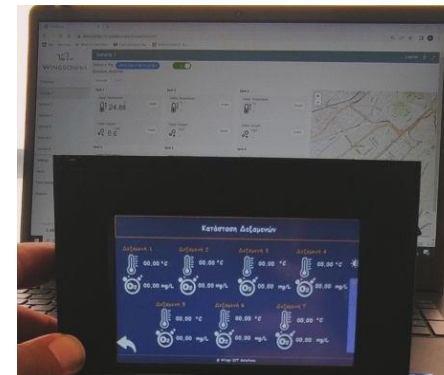
B. Industry & Logistics: Quality Inspections
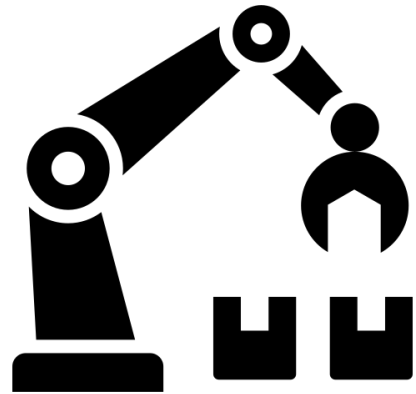
x2-x4: increase in the volume of pictures analyzed (3 → 6/12 fps)

Analysis of **higher quality** images, towards the 100% inspection vision

Higher quality at high **speed** of production

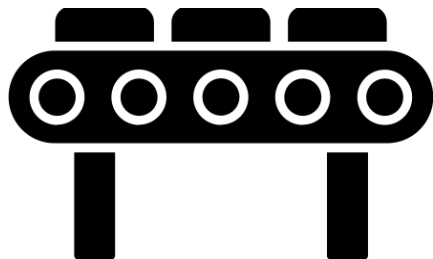# B. Industry & Logistics: Digital Twins / Testing

Actions

1. Monitoring
2. Simulation / Testing
3. Predictions (e.g., demand)
4. Planning / decision support for procurement / just in time

B. Industry & Logistics: Benefits from 5G SA

A >30% increase in production speed

Guidance accuracy in the order of few cm (e.g. 3-4)

>100% increase in the image analysis potential (>6 fps)

Drastic enhancement in Productivity, Maintenance Efficiency, Security, Worker Safety

C. WINGSCity: Smart City Platform

C. Health & Wellness (Private or Public Sector)

STARLIT: Solutions for digital **health** and wellness based on artificial intelligence and IoT

Data Analysis
Prediction
Data Ingestion
Data Management
Decision Making

STARLIT — Digital Solutions for Health & Wellness
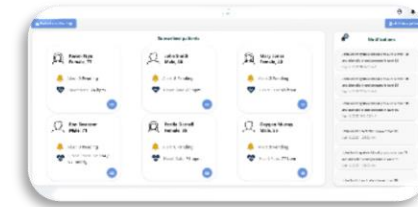
Dashboard
(Patient View)

Real-time vital signs monitoring & predictions

Video Conference with doctors

Notifications/Alerts

Data download

Dashboard
(Doctor View)

Patients on a single page & on the map

Real-time vital signs monitoring & predictions

Video Conference with patients

Notification/Alerts management

Live-Streaming/Remote Support

Ultrasound Images (DICOM)

Data download

Wearable devices

Patients
Real-time vital signs monitoring (ECG, Blood pressure, SpO2, GPS, etc.)

Home

IoT and AR devices

Paramedic
Live video streaming with remote doctor and ultrasound images for quicker and more confident clinical decisions

Ambulance

Healthcare Professional
Better management of cardiovascular, neurological, chronic and other diseases

Hospital

D. Aquaculture

Sensors and **Camera**
Water Quality and Status.
Water Currents.

Drones
(Infrastructure inspection, feed losses)

Remote sensing
(meteorological data)

5G, 4G, NB-IoT, LoRa, Bluetooth, Wireless M-Bus, MQTT, IwM2M

WINGS Edge Gateway

Public Private Hybrid

kafka mongoDB Spark hadoop

docker kubernetes BLOCKCHAIN

Gateway
Sensors
Cameras
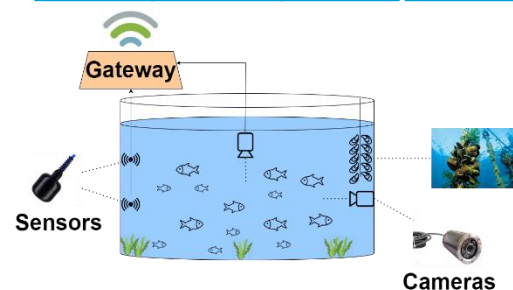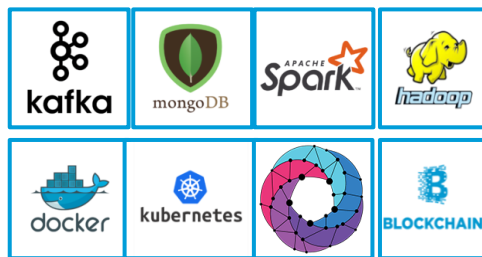
ARTIFICIAL INTELLIGENCE IN CLOUD / EDGE

✓ **Stock** monitoring: Instant overview of the fish welfare of the farm, based on real time data, derived from sensors and cameras.

✓ **Environment** monitoring: Measurements on environmental parameters such as temperature, pH, salinity, current, dissolved oxygen, turbidity, chlorophyll, nitrate and ammonium, with the use of underwater sensors.

✓ **Average weight** estimation with video analysis: Calculation of fish average weight with video analytics, avoiding the stress caused to the fish from sampling procedures.

✓ **Feeding** optimization: feeding recommendations.

✓ **Disease** prevention and mitigation: Disease detection through behaviour patterns.

<u>US Patent Application</u>: Title: AUTOMATED SYSTEM AND METHOD FOR ESTIMATING AVERAGE FISH WEIGHT IN AN AQUACULTURE ENVIRONMENT Serial No: 18/100,509; Filing Date: January 23, 2023; Our Ref: 15076-01297US

12/14/2023

D. Aquaculture: Traction / Installations
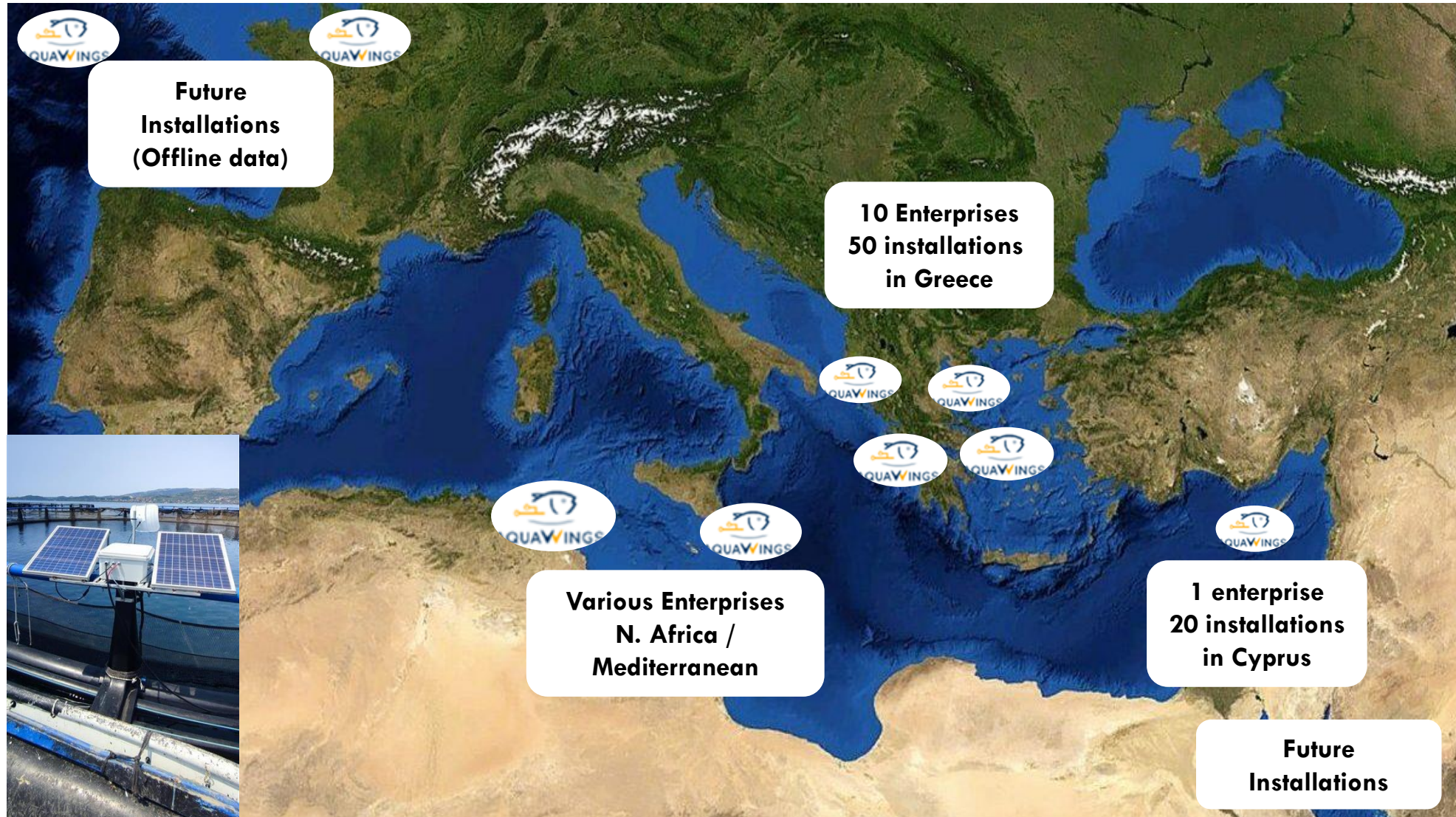
Beyond 5G, Towards 6G

Facilitate Complex Tasks: Inventory Management
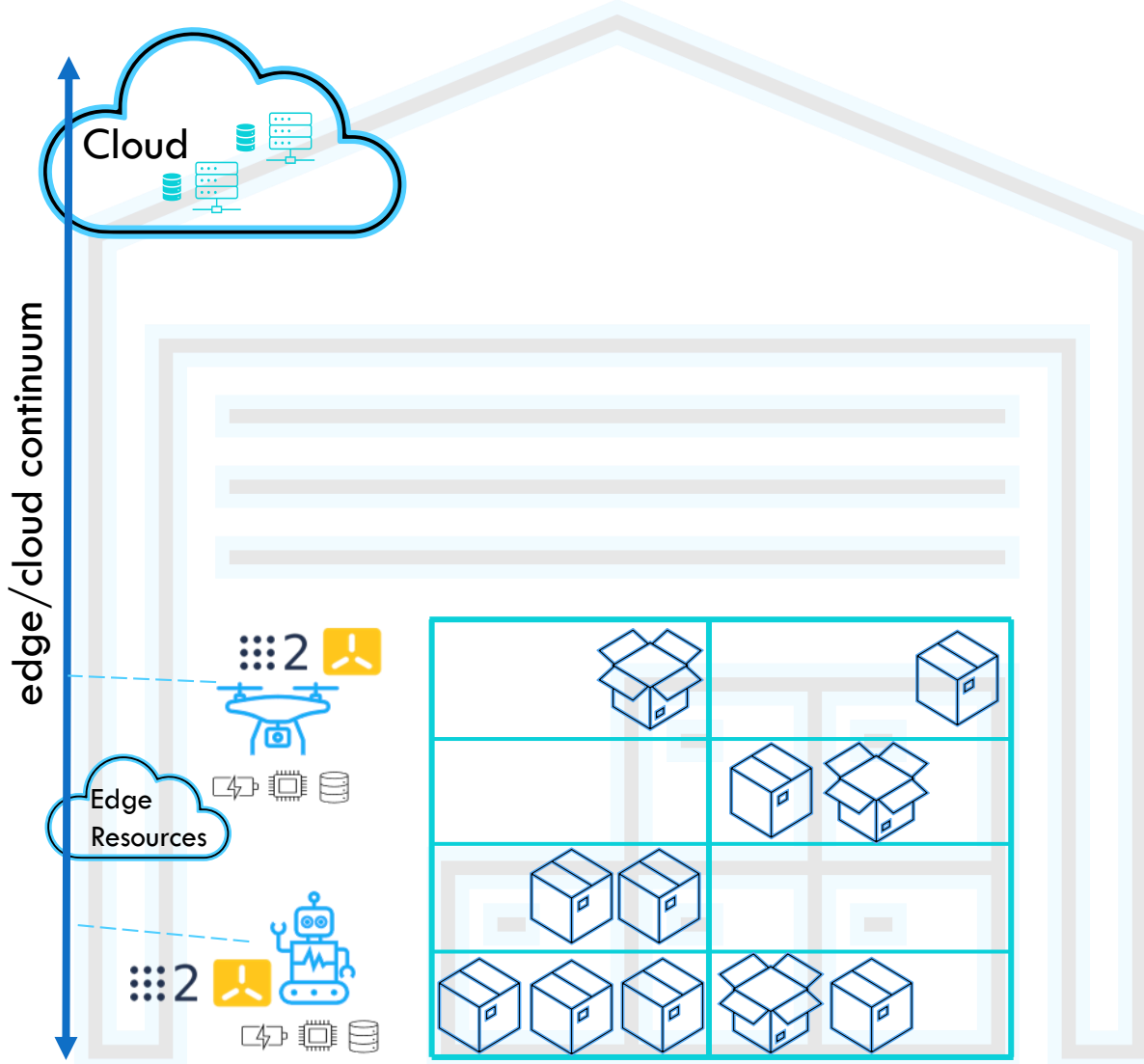
Advanced Features for Applications:

- Cobots (autonomous robots, UAVs, human in the loo), Massive Twinning, XR

Social Considerations

- Sustainability (Environmental and other perspectives), Inclusion, Trustworthiness

Scenario

- Intent: area to be covered
- Task allocation: devices to sub-areas
- Functionality: activation, deployment, chaining
- Task realization: cooperation of devices and humans.

Requirements for next generation:

- Extreme connectivity: latency, bit rate
- Joint Communications and Sensing
- Flexible allocation of functionality & topology formulations

Summary

☐ Immense opportunities in the applications domain

☐ Foundation: infrastructures, geopolitics, economy

☐ WINGS offer: applications that are robust, validated with respect to functional and non-functional features

☐ Flexibility and Capacity

☐ Time for Actions

Contact Information

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B. Industry & Logistics: Benefits from 5G SA

Bit Rate: Use of uncompressed video *and/or* of compressed video corresponding to higher quality images

Flexibility: Functionality in server *and/or* split; Clever allocation of cost of robots

Mobility: Handover between cells
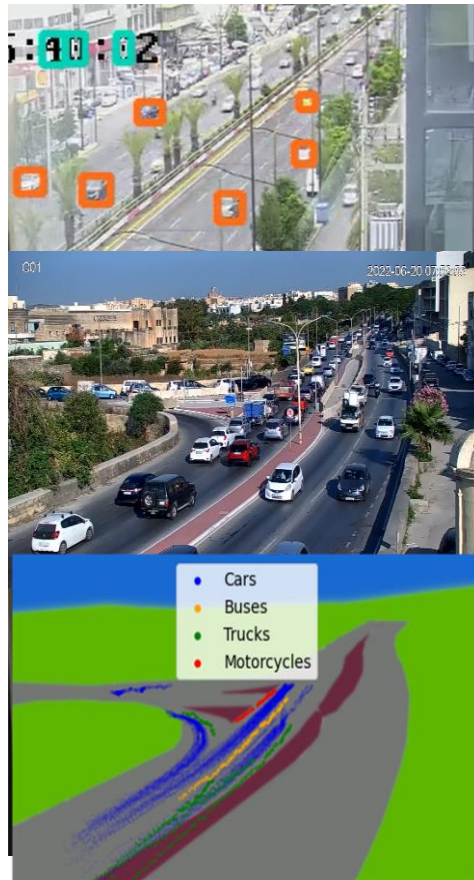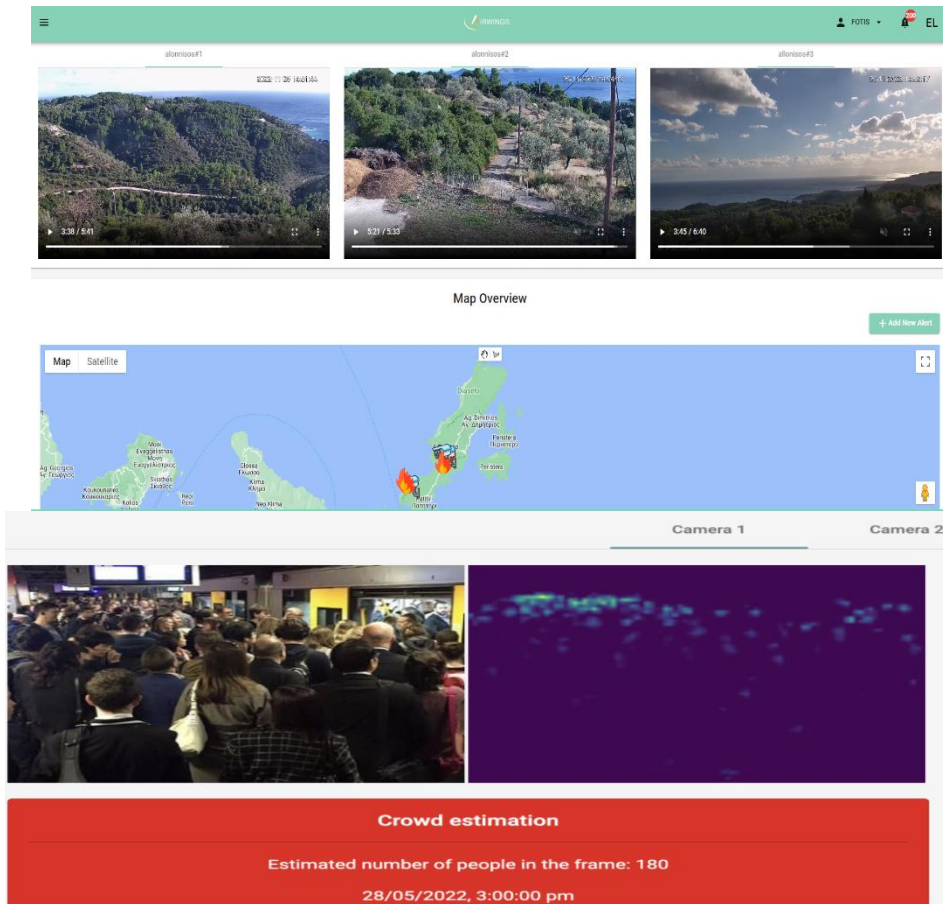
Robustness: Managed by experts; Accountability

Security: Stronger models and assurance

Digital Transformation of Cities

<u>Covering all important factors for liveability</u>

- **Air, Environment** / **Civil** Protection, **Water** / **Energy** / **Gas, Transportation** optimization, **Health** / **Wellness** aspects
- Products engaged: **AIRWINGS, ARTEMIS, WINGSPARK, STARLIT**

WINGS ICT SOLUTIONS

INNOVATION FOR SUSTAINABILITY AND GROWTH

We develop
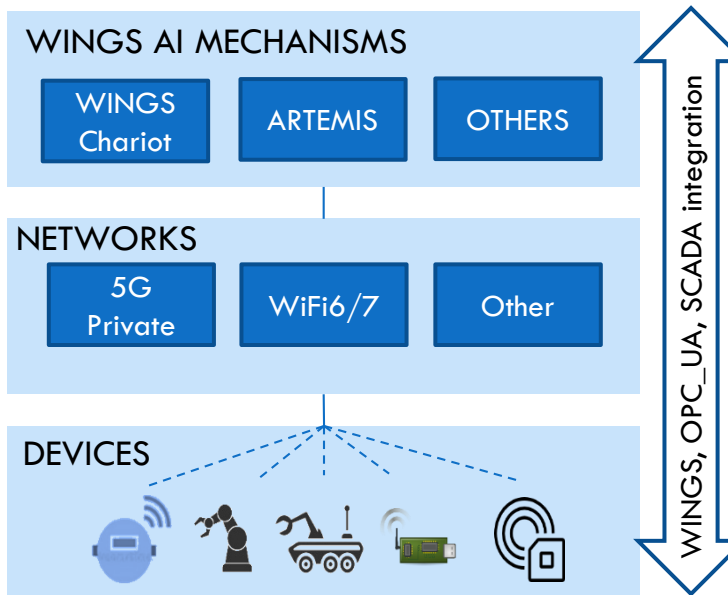the technology of tomorrow
to improve
our cities today

6. Industry / Logistics

Key factors for smart manufacturing

- **Sustainability,** Energy efficiency, **Automation** / Intelligence, **Resilience,** Worker **wellness** / comfort
- Products engaged: **WINGSChariot, ARTEMIS, AIRWINGS, STARLIT**
- **Robotics,** sensors, **networks,** big data, **AI,** XR, digital twins, integration with legacy technologies (SCADA), leverage on standards (OPC-UA)
- Raw material inspection, process optimization, energy / resource efficiency, assemblies, welding, product quality check, logistics optimization
- **Process** industries (food, cement, etc.), **Discrete** manufacturing (machines, etc.)

WINGS AI MECHANISMS

| WINGS Chariot | ARTEMIS | OTHERS |

NETWORKS

| 5G Private | WiFi6/7 | Other |

DEVICES

WINGS, OPC_UA, SCADA integration

Technologies for
SMART MANUFACTURING
to Unleash Productivity, Resilience & Sustainability

WINGS Solutions for Smart Manufacturing