5G-ENABLED SMART PORTS: EXPERIENCES AND PROSPECTS

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WORKSHOP
5G & GOVTECH
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ABOUT US
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ICCS
ICCS is the oldest and largest academic Research Institute in Greece. Being the research branch of the School of Electrical and Computer Engineering of the National Technical University of Athens (NTUA), ICCS conducts interdisciplinary cutting edge research and R&D activities in in relevant scientific fields, supports doctoral theses, undertakes innovative & development activities and provides scientific services to private & public bodies in Greece and abroad.

RESEARCH IMPACT
With a mission to promote basic and applied research, advance digitalisation and boost innovation, ICCS today stands among the top 3 Research Institutions in Greece. It is also ranked among the top 20 European institutes in terms of research funding in its fields. Committed to the highest standards of academic research, the Institute maintains well organised facilities based in Athens and a reputation as a top-level research institution worldwide.
R&D Projects
At ICCS, we continuously advance our expertise and scientific knowledge through the participation of our research teams in National and European R&D projects in various scientific fields.

Researchers & Scientific Personnel
Excellent research staff lies at the basis of ICCS’s success. More than 800 highly qualified researchers, scientists and faculty members are the main pillar of the Center’s successful performance.

Innovation
ICCS actively supports the creation of startups and participates in successful spinoffs such as 'The first Greek Energy Competence Center'.

Scholarships & Excellence
With an aim to promote scientific excellence, ICCS every year provides scholarships to PhD students and supports a number of Educational activities.
SMART PORTS
WHAT IS A SMART PORT?

“A smart port equips the workforce with relevant skills and technology to solve the unique internal and external challenges of the organisation, and to facilitate the efficient movement of goods, delivery of services and smooth flow of information.”


“…a connected port that protects the environment and mobilizes innovative technologies for business process and information flow management.”


“…a modern and technologically advanced port that leverages innovative technologies and data-driven solutions to enhance its operational efficiency, safety, and sustainability.”


“…a connected, automated port designed to meet stakeholder demand.”

SMART PORT EXAMPLES

Smart Sound Plymouth (UK)

Port Oulu (FI)

Smart Port Rotterdam (NL)

Port of Hamburg (DE)
SMART PORT APPLICATIONS

Port operations: offshore / onshore
- Vessel / crane / truck monitoring, traffic management

Remote control
- Vessels / cranes / trucks

Safety
- Workers, goods

End-to-end logistics
- Vessel-port-truck-logistics hub

Connectivity services
- Seamless roaming

Digital Twins
- Holistic environment

Source: Nexus Integra
ENABLING TECHNOLOGIES

Connectivity
- 5G System
- Satellite/NTN
...

Cloud / Edge Computing
- Cloud native technologies
- Variable HW incl. AI support

IoT Technology
- Sensing/actuation
- Embedded computing

AI / ML
- Video analytics,…
- MLOps

Blockchain
- Smart contracts
THE ROLE OF 5G

Enhanced performance
• Data rates (eMBB)
• Latency & reliability (URLLC)
• Device density (mMTC)

Service differentiation
• Network Slicing
• Cloud Native

Vertical – Network Interaction
• Network Exposure Function (NEF)
• Application Function (AF)
• CAMARA GSMA/LF

Source: Huawei
OUR EXPERIENCE
Partners | Role
---|---
Institute of communication and computer systems (ICCS) | Living Lab Coordinator (5G-IoT, NFV-MANO, AI/ML)
Vodafone (Innovus) | Mobile Network Operator
Piraeus Container Terminal (PCT) | Living Lab

5G & AI-enabled Use Cases

- Surveillance and monitoring
- Container seal detection
- Collision warning

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PRIVATE 5G NETWORK AND 5G-IoT PLATFORM

5G System (5GS)

Far-edge Cloud

5G-IoT Nodes

5G Network and 5G-IoT Platform

5G System (5GS)

Far-edge Cloud

5G-IoT Nodes

AI-enabling HW (GPUs)
COLLISION WARNING
CONTAINER SEAL DETECTION

1. Container detection
2. Seal detection

Training Set: 50K -> 500K images
Validation: 30 hours

~125ms
~40ms
LESSONS LEARNED

User requirements ↔ technology capabilities
What is needed ↔ what is possible

Operational environment
Often harsh / unpredictable conditions

Requirement analysis
Design
Development
System integration
Testing / Verification
Validation / Evaluation

Complex, multi-technology environment
Device – Network – Cloud – Application | APIs
TOWARDS TESTBEDS / SANDBOXES
AND TAKING THE FIRST STEPS

Collaboration environment
co-creation processes

- Capturing operational needs
- Grasping novel technology capabilities
- Bridging technology domains
- Extensive experimentation

Address market needs
Provide end-to-end solutions
Ensure maturity / robustness
THANK YOU!

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