

SOCFAI

AI-powered insights for port and airport efficiency

To improve port and airport operations, the ITEA project SOCFAI (Secure Open Collaboration Framework powered by Artificial Intelligence) developed collaborative frameworks and artificial intelligence (AI)-supported modules that enable real-time situational awareness and predictive optimisation.

Airports and ports are collaborative, multi-stakeholder environments. However, both suffer from fragmented and non-interoperable systems, conflicting objectives, and a lack of clear overview. This causes a variety of issues: disconnected sensing and monitoring systems prevent the timely detection of anomalies and risks, inefficient energy and resource management leads to increased emissions, and a lack of predictive insight causes cascading delays and disruptions. In airports, passenger satisfaction also drops when limited overviews reduce the capacity to optimise their experience.

Project developments

Building on state-of-the-art technology and standards, SOCFAI aimed for real-time situational awareness and predictive, fully integrated management and optimisation of airport operations and port logistics. In the airport use case, this took the form of an AI-powered collaboration framework in which a secure, open-source environment connects heterogeneous airport data with lower deployment effort. A series of modules address areas in which airports can improve efficiency, sustainability, responsiveness, and passenger experience, including predictive baggage analytics, passenger flow intelligence, air quality monitoring, and dynamic energy management. In the port use case, attention was focused on container movement: a framework was developed that features blockchain technology to enable trusted, tamper-proof collaboration and real-time predictive algorithms for AI-based optimisation. This

has also been designed for plug-and-play integration and interoperability with legacy systems to support scalability.

A major strength of SOCFAI was the involvement of end-users within the consortium. This meant that the respective frameworks could be used to monitor one airport and three port warehouses during the project, enabling validation of the results with real data. This also offered unique opportunities for collaboration. For instance, TAV Technologies has operated İzmir Adnan Menderes Airport for 20 years and faced difficulties extracting data from their older energy management systems, but Singaporean SME Inverse was able to provide a new integration method to achieve this and thereby allow the data to be utilised in other operational processes. Likewise, KULS provided a testbed and ten operators at Busan New Port in South Korea to support the validation of AI-powered port logistics. As a result, the Korean partners have established a joint beachhead for local expansion, followed by platform scale-up to other national ports and beyond.

Results so far

By validating their results in real environments, SOCFAI has already been able to demonstrate major benefits for

the users of both its frameworks and the corresponding ports and airports. On a technical level, the average time between data generation and availability in the platform was targeted at two hours. Instead, near real-time availability has been achieved. SOCFAI also targeted a reduction in the effort required to develop and deploy machine learning models, aiming to bring the average time down to six weeks. The



project surpassed this objective, achieving a further reduction and lowering the average time to just four weeks. Efficiency gains have also been felt at the ground level: in ports, the average number of containers processed per hour or day has been improved by 7% and, in airports, the ratio of misconnected transfer bags to total transfer bags fell from 0.21% to just 0.1%. The former is the basis for cost savings and higher revenues in ports, while the latter represents a mission-critical issue that all airports must address to avoid delays and customer dissatisfaction – examples of how SOCFAI's efficiency gains soon translate into a variety of knock-on benefits.

An important enabler of these innovations was open-source AI contributions, which SOCFAI used to create more dynamic visualisations. Given the hundreds of parameters being measured, this offered

an unprecedented degree of real-time insight. The project has now returned the favour by making its framework components available as open source, through which companies outside the consortium can develop commercial modules. As for the existing modules, 14 patents have been granted, seven of which will be commercialised within the next two years as new products, services or enhancements. Collaboration between the partners will continue throughout the short and long-term exploitation plans. For the airport use case, a 10-15% reduction in manual coordination effort is expected via integrated visibility. In the port use case, the Korean partners plan to jointly commercialise the framework across Southeast Asia, particularly in Vietnam via an export promotion strategy event where local partnership-building activities and market research were conducted in 2025.

South American and African customer bases are also represented across the consortium, providing SOCFAI with uncommon market opportunities for an ITEA project.

Future outlook

Regarding other post-project activities, SOCFAI's airport partners view their results as data infrastructure that can provide a basis for future airport digital twin solutions; they are therefore searching for digital twin partners to explore this. Meanwhile, the project's results are being further developed in the ongoing ITEA projects SINTRA and STRUCTURE, which focus respectively on the protection of critical infrastructures and the automation of transport infrastructure inspection and maintenance. All in all, this positions SOCFAI as a productive and impact-oriented project long after its completion.

Major project outcomes

Dissemination

- > 9 publications and 9 presentations at conferences/fairs

Exploitation (so far)

6 new products

- > Advanced Traffic Management and Flow Optimization
- > Innovative Environmental Monitoring and Management
- > Smart Baggage Handling
- > Energy Efficiency and Sustainability Initiatives
- > Advanced Predictive Analytics for Flight Delays and Resource Allocation
- > Real-Time Common Situational Awareness Platform

1 new service

- > Robust Data Privacy and Security Framework

6 new systems

- > Data Confidentiality Function of Blockchain-Based Multi-Party Port Logistics Data Sharing Platform
- > Port Logistics CFS Integrated Control Web Portal Program
- > Smart Port Logistics CFS Blockchain-Based Trust Verification Program
- > Smart Port Logistics CFS Integrated API Gateway Program
- > Automated Container Placement and Management Processes
- > Energy Consumption Optimization System for Airport

Standardisation

- > SOCFAI contributes to standardisation mainly through the adoption, alignment and potential extension of existing standards related to secure data exchange, AI governance, airport interoperability, cloud security and privacy-preserving monitoring.
 - IATA AIDX / IATA, EU AI Act / EU, GDPR / EU, OAuth 2.0, JWT / IETF, ISO/IEC 27001 / ISO-IEC, ISO/IEC 27017, ISO/IEC 27018 / ISO-IEC, ISO/IEC 23053 / ISO-IEC, MCP / Open AI ecosystem

Patents

- > 10 patent applications filed + 4 patent application in preparation

Spin-offs

- > 1 Spin-off - RMS Multi-KPI Optimization Framework

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Partners

Republic of Korea

- > eINS S&C Co., Ltd
- > INJE University
- > KAIST
- > Kuls

Singapore

- > Enverse

Türkiye

- > inosens
- > Netas Telekomunikasyon A.S.
- > Siemens
- > TAV İzmir Adnan Menderes Airport
- > TAV Technologies

Project start

July 2023

Project end

September 2026

Project leader

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