BAG-INTEL

D2.1: End users, legal and ethical requirements

(first version)

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* R: Document, report (excluding the periodic and final reports)

DEM: Demonstrator, pilot, prototype, plan designs

DEC: Websites, patents filing, press & media actions, videos, etc.

DATA: Data sets, microdata, etc.

DMP: Data management plan

ETHICS: Deliverables related to ethics issues.

SECURITY: Deliverables related to security issues

OTHER: Software, technical diagram, algorithms, models, etc.

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Chapter I: End Users requirements

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EXECUTIVE SUMMARY

In this document, in Chapter I, we provide the End-User requirements specification document of the BAG-INTEL system as part of the first version of the series of deliverables *"End users, legal and ethical requirements"* (D2.1).

In Chapter II of this same document and as part of the first version of the series of deliverables *"End users, legal and ethical requirements"* (D2.1), we provide the Legal and Ethical Requirements for BAG-INTEL.

In the following paragraphs we'll provide the Executive Summary of Chapter I, while the Executive Summary of Chapter II is provided at the beginning of Chapter II in this same document.

The main aim of the BAG-INTEL project is to assist border and custom authorities to detect baggage containing contraband in an effective and real-time manner. BAG-INTEL will provide robust AI based information utilization and decision support tools to support the stakeholders of the project (primarily Customs, Police and Airport Operators), for increased effectiveness and efficiency of the customs control of air traveller baggage.

In order to perform the Stakeholder requirements definition process for BAG-INTEL, we have followed the methodology presented in the ISO/IEC/IEEE 29148:2011 international standard. The purpose of the process is to define the requirements for a system that can provide the services needed by users and other stakeholders in a defined environment.

In respect to the Stakeholder Requirements Definition Process the Stakeholder Elicitation Activity has been followed. Within the activity:

1. Individual stakeholders and stakeholder classes have been identified, who have a legitimate interest in the system throughout its life cycle and

2. Stakeholder Requirements were elicited from the identified stakeholders and agreed.

The elicitation of the requirements for the BAG-INTEL project has been performed through a series of eleven (11) teleconferences with the End-Users as also through workshops that took place during the BAG-INTEL plenary meeting between 6/3/2024 and 7/3/2024. The workshops also structured the Use Case scenarios presented in Chapter I.

The following Requirement Processes will be followed for BAG-INTEL:

1. Stakeholder requirements definition process (ISO/IEC 15288:2008),

2. Requirements analysis process (ISO/IEC 15288:2008) and

3. Software requirements analysis process (ISO/IEC 12207:2008) and Architectural Design Process

Both iterative and recursive application of the above processes are performed for BAG-INTEL. The iterative methodology is applying repeatedly on the same level of the system, while the recursive applications of the processes is performed at successive levels of system elements within the system structure.

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The following different sets of requirement information will be produced:

- The stakeholder requirements specification (StRS) (Chapter I of this document).
- The system requirements specification (SyRS) (Deliverable D2.3).
- Software requirements specification (SRS) (Deliverable D2.3).

As the activity of allocating requirements to system elements is part of the architectural design process and proceeds in parallel with the definition of the system architecture, the System requirements specification document (SyRS) and the Software requirements specification document (SRS) will be included in deliverable (D2.3).
In this Chapter I, we present the Stakeholder Requirements specification (StRS) document.

Through the elicitation activity, the Stakeholder Requirements and the associated information for their attributes have been gathered. Six (6) scenarios for the three (3) Use Cases of BAG-INTEL have been developed and agreed with the primary stakeholders of the respective three (3) pilots, i.e. Billund Airport, Denmark (small international airport), Thessaloniki Airport 'Makedonia', Greece (medium international airport) and Adolfo Suárez Madrid–Barajas Airport, Spain (large international airport).

The scenarios have been customized based on the idiosyncratic characteristics and requirements of each airport. This is also related to the customization of the BAG-INTEL sub-systems. Due to the large shipping and operational costs and the time constraints for shipping the X-ray/CT scanner to all three airports, it was decided by the BAG-INTEL consortium that only the Billund Airport, Denmark will be hosting the X-ray/CT scanner physically, while the other two airports will be testing the BAG-INTEL system through simulated signals which will be generated by the X-ray/CT scanner for the different scenarios. This way the X-ray/CT scanner will be simulated for the two airports with the process being transparent for the rest of the sub-systems of BAG-INTEL during its end-to-end demonstration.

As it will be seen in the respective information in the following sections, the primary stakeholders of the Customs of all 3 pilots have agreed on all end-user requirements presented in this document. This shows the reality of the BAG-INTEL system becoming part of a global, highly standardized chain of operations in international airports, which are expected to have very common requirements. Customization alternatives for each airport naturally take place, based on specific operational requirements and constraints for each airport.

The main differentiation of each Use Case, is the experience they will be receiving in their respective scenarios with the different levels of ability of the BAG-INTEL system for automatic detection of different categories of narcotics having different chemical structures, at different quantities, concealed in different ways. ***As the ability of the AI algorithms of the X-ray/CT scanner to recognize narcotics, will be developed for the first time, such detection will be the first time to be achieved in a real airport-operations setting.***

Thus Billund Airport, Denmark will be demonstrating the ability of the BAG-INTEL system to detect ("hash" – Contraband X), Thessaloniki Airport 'Makedonia', Greece to detect ("brown heroin" – Contraband Y) and Adolfo Suárez Madrid–Barajas Airport, Spain to detect ("Cocain" – Contraband Z).

The document concludes with the Requirements Traceability Matrix which links requirements to their origin and traces them throughout the project life cycle.

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ABBREVIATIONS

RTM	Requirements Traceability Matrix
SRS	Software Requirements Specification
StRS	Stakeholder Requirements Specification
SyRS	System Requirements Specification

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1 INTRODUCTION

In Chapter I, we provide the End-User requirements specification document of the BAG-INTEL system as part of the first version of the series of deliverables *"End users, legal and ethical requirements"* (D2.1).

In Chapter II of this same document and as part of the first version of the series of deliverables *"End users, legal and ethical requirements"* (D2.1), we provide the Legal and Ethical Requirements for BAG-INTEL.

Chapter I provides the End-User requirements specification document (Stakeholder Requirements specification document based on the ISO/IEC/IEEE 29148:2011 standard [1] - thus we'll be using the terms "End-User requirements" and "Stakeholder requirements" interchangeably) while Chapter II provides the legal and ethical requirements for the project.

As we address legal and ethical issues by design, the Stakeholder requirements in Chapter I, have also been addressed from the perspective of legal and ethical considerations and the respective recommendations have been included in the information associated with each one of the end-user requirements.

Chapter I presented in the sections to follow, introduces the Stakeholder Requirements Specification (StRS) [1][4] for the BAG-INTEL project. It discusses the purpose, scope and content of the document and provides an overview of the functionality that is addressed by the requirements. The sections of Chapter II (on section 7 of this document) will be provided immediately after Chapter I concludes in this same document.

1.1 PURPOSE AND SCOPE

The main aim of the BAG-INTEL project is to assist border and custom authorities to detect baggage containing contraband in a rapid and effective manner. BAG-INTEL will provide robust AI based information utilization and decision support tools to support the stakeholders of the project (primarily Customs, Police and Airport Operators), for increased effectiveness and efficiency of the customs control of air traveller baggage.

Within the scope of the whole project, and through a series of elicitation activities, stakeholders established basic requirements, defined overriding project constraints, and addressed major features and functions that must be present for the BAG-INTEL system to meet its objectives. The information was refined and expanded and Use Case scenarios were developed. A requirements model was created and priorities were assigned. The scope of the BAG-INTEL system and the corresponding requirements is illustrated in Figure 1.

Through the elicitation activities [1][5], the Stakeholder Requirements and the associated information for their attributes have been gathered (section 3.5).

In this first version of the document, six (6) scenarios for the three (3) Use Cases of BAG-INTEL have been developed by the primary stakeholders of the respective three (3) pilots, i.e. Billund Airport, Denmark (small international airport), Thessaloniki Airport 'Makedonia', Greece (medium international airport) and Adolfo Suárez Madrid–Barajas Airport, Spain (large international airport) (sections 3.6, 3.7, 3.8). Additional scenarios will be developed during the project and will be included in the second and final version of the document (D2.2 M32).

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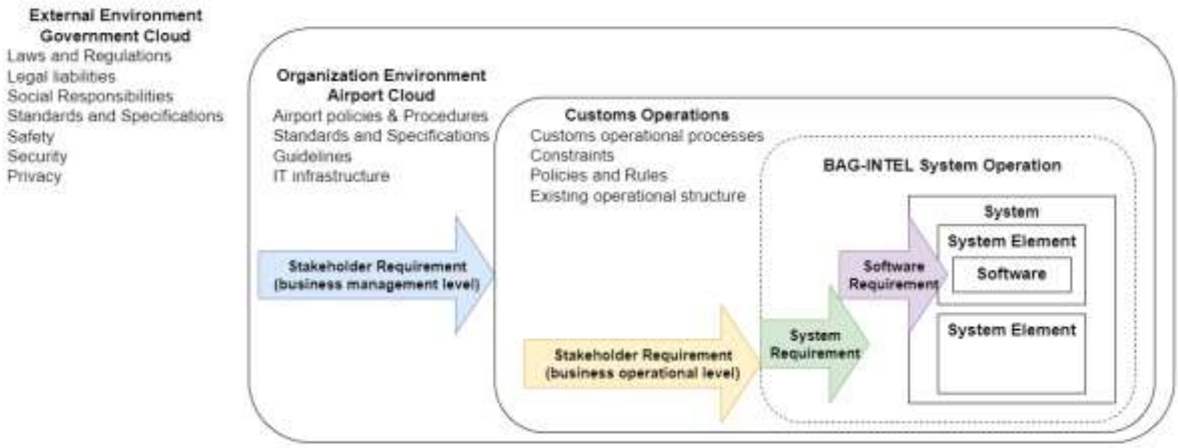

Figure 1: Requirements Scope in the BAG-INTEL airport-operations context

At the completion of the elicitation process, Stakeholder Requirements and Use Case scenarios were reviewed and approved by the Customs Authorities of all 3 Use Cases and by other important stakeholders (where applicable).

The primary stakeholders of the Customs of all 3 pilots have agreed on all end-user requirements presented in this document. The approval is listed in the respective information for each Stakeholder Requirement (section 3.5). This shows the reality of the BAG-INTEL system becoming part of a global, highly standardized chain of operations in international airports, which are expected to have very common requirements. Customization alternatives for each airport naturally take place, based on specific operational requirements and constraints for each airport.

The scenarios have been customized based on the idiosyncratic characteristics and requirements of each airport. This is also related to the customization of the BAG-INTEL sub-systems. Due to the large shipping and operational costs and the time constraints for shipping the X-ray/CT scanner to all three airports, it was decided by the BAG-INTEL consortium that only the Billund Airport, Denmark will be hosting the X-ray/CT scanner physically, while the other two airports will be testing the BAG-INTEL system through simulated signals which will be generated by the X-ray/CT scanner for the different scenarios. This way the X-ray/CT scanner will be simulated for the two airports with the process being transparent for the rest of the sub-systems of BAG-INTEL during its end-to-end demonstration.

The main differentiation of each Use Case, is the experience they will be receiving in their respective scenarios with the different levels of ability of the BAG-INTEL system for automatic detection of different categories of narcotics having different chemical structures, at different quantities, concealed in different ways. ***As the ability of the AI algorithms of the X-ray/CT scanner to recognize narcotics, will be developed for the first time, such detection will be the first time to be achieved in a real airport-operations setting.***

Thus Billund Airport, Denmark will be demonstrating the ability of the BAG-INTEL system to detect (“hash” – Contraband X), Thessaloniki Airport ‘Makedonia’, Greece to detect (“brown heroin” – Contraband Y) and Adolfo Suárez Madrid–Barajas Airport, Spain to detect (“Cocain” – Contraband Z).

The document includes a Requirements Traceability Matrix (section 4) which links requirements to their origin and traces them throughout the project life cycle.

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The purpose of the whole process is to develop a realistic project plan and validate each requirement and the requirements model as a whole against End-User needs, in order to ensure that the right system is to be built. The analysis of the Stakeholder Requirements drives the development of the architecture and the StRS document accompanies the project during its lifetime.

1.2 STAKEHOLDERS

Table 1 presents a tabulation of the BAG-INTEL Stakeholders. Primary-Leading Stakeholders include Customs and Airport Operators and correspond to the 3 pilot sites and respective Use Cases of BAG-INTEL (ETCB is also a Primary-Leading Stakeholder).

Primary-Leading Stakeholders have explicitly agreed on all Stakeholder Requirements applicable to them, presented in this document during respective workshops (via teleconferencing).

Especially customs from all 3 pilots of the BAG-INTEL project, have agreed on all Stakeholder Requirements presented in this document. Primary Stakeholders are important stakeholders who work in a team with the Primary-Leading Stakeholders. Multiple technical partners of the BAG-INTEL project are Primary stakeholders as they seek innovation and improvement of their offerings. During the elicitation activities, BAG-INTEL technical partners worked closely with the Pilots in order to develop technology offerings that will server the End-User requirements. During the elicitation process and during the analysis of the End-User requirements, BAG-INTEL legal and ethical requirements partners, have contributed to the process by providing recommendations on the legal and ethical aspects of each end-user requirement.

Table 1: BAG-INTEL Stakeholders

Organization	Type	Main Interests	Impact of Project
Billund Airport, DK: TOLD	Primary, Leading	Safety, Security, Taxation, Operations	High
Thessaloniki Airport “Makedonia”, GR: IAPR	Primary, Leading	Safety, Security, Taxation, Operations	High
Thessaloniki Airport “Makedonia”, GR: FG	Primary, Leading	Safety, Security, Taxation, Operations	High
Thessaloniki Airport “Makedonia”, GR: HPOL	Primary	Safety, Security, Taxation, Operations	High
Thessaloniki Airport “Makedonia”, GR: KEMEA	Primary	Safety, Security, Taxation, Operations	High
Adolfo Suárez Madrid–Barajas Airport, ES: GUCI	Primary, Leading	Safety, Security, Taxation, Operations	High

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Organization	Type	Main Interests	Impact of Project
Adolfo Suárez Madrid–Barajas Airport, ES: AEAT	Primary, Leading	Safety, Security, Taxation, Operations	High
Estonian Tax and Customs Board: ETCB	Primary, Leading	Safety, Security, Taxation Operations	High
Multiple Technical Partners (technology providers)	Primary	Innovative and Improved Technology Solutions	High
Multiple partners on Legal and Ethical requirements	Primary	Legal and Ethical assessment	High

1.3 METHODOLOGY

We have followed the Stakeholder requirements definition process as this is presented in the ISO/IEC/IEEE 29148:2011 international standard. The purpose of the process is to define the requirements for a system that can provide the services needed by users and other stakeholders in a defined environment. The process, identifies stakeholders involved with the system throughout its life cycle and their needs, expectations and desires. The BAG-INTEL stakeholders and stakeholder classes are provided in section 1.3, Table 1.

The process analyzes and transforms this information into a common set of stakeholder requirements that express the intended interaction the system will have with its operational environment and become the reference against which each resulting operational service is validated.

The successful implementation of the Stakeholder Requirements Definition Process

1. The required system characteristics and context of use of the product functions and services, and operational concepts are specified. Such functions and services in the form of technologies/services offered by the BAG-INTEL system are provided in section 3.2

2. The constraints on a system solution are defined.

3. Traceability of stakeholder requirements to stakeholders and their needs is achieved. Association of Stakeholder requirements with Use Cases per stakeholder is provided in the requirements traceability matrix in section 4.

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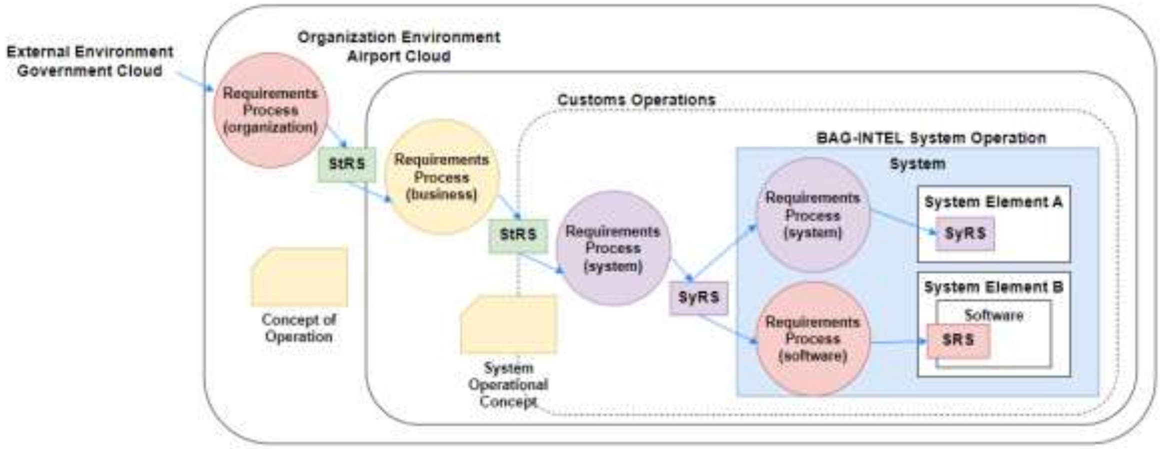

Figure 2: The sequence of requirements processes and specifications for BAG-INTEL

4. The stakeholder requirements are defined. A list of stakeholders requirements and associated attributes is provided in section 3.5.

5. Stakeholder requirements for validation are identified.

In respect to the Stakeholder Requirements Definition Process, Stakeholder Elicitation Activity is followed. The activity:

1. Identifies the individual stakeholders or stakeholder classes who have a legitimate interest in the system throughout its life cycle and

2. Elicits Stakeholder Requirements from the identified stakeholders.

The elicitation of the requirements for the BAG-INTEL project has been performed through a series of eleven (11) teleconferences with the End-Users as also through a workshop that took place during the BAG-INTEL plenary meeting between 6/3/2024 and 7/3/2024. The workshops also structured the Use Case scenarios presented in sections (3.6, 3.7, 3.8)

The following Requirement Processes will be followed for BAG-INTEL:

1. Stakeholder requirements definition process (ISO/IEC 15288:2008) [2],

2. Requirements analysis process (ISO/IEC 15288:2008) and

3. Software requirements analysis process (ISO/IEC 12207:2008) [3] and Architectural Design Process

Both iterative and recursive application of the above processes is performed for BAG-INTEL. The iterative methodology is applied repeatedly on the same level of the system, while the recursive application of the processes is performed at successive levels of system elements within the system structure.

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The following different sets of requirement information are developed Figure 2.

- The stakeholder requirements specification (StRS)
- The system requirements specification (SyRS)
- Software requirements specification (SRS)

As the activity of allocating requirements to system elements is part of the architectural design process and proceeds in parallel with the definition of the system architecture, the System requirements specification document (SyRS) and the Software requirements specification document (SRS) will be included in deliverable (D2.3).
In this Chapter I, we present the Stakeholder Requirements specification (StRS) document.

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2 BUSINESS MANAGEMENT REQUIREMENTS

2.1 OVERVIEW OF THE BAG-INTEL SYSTEM

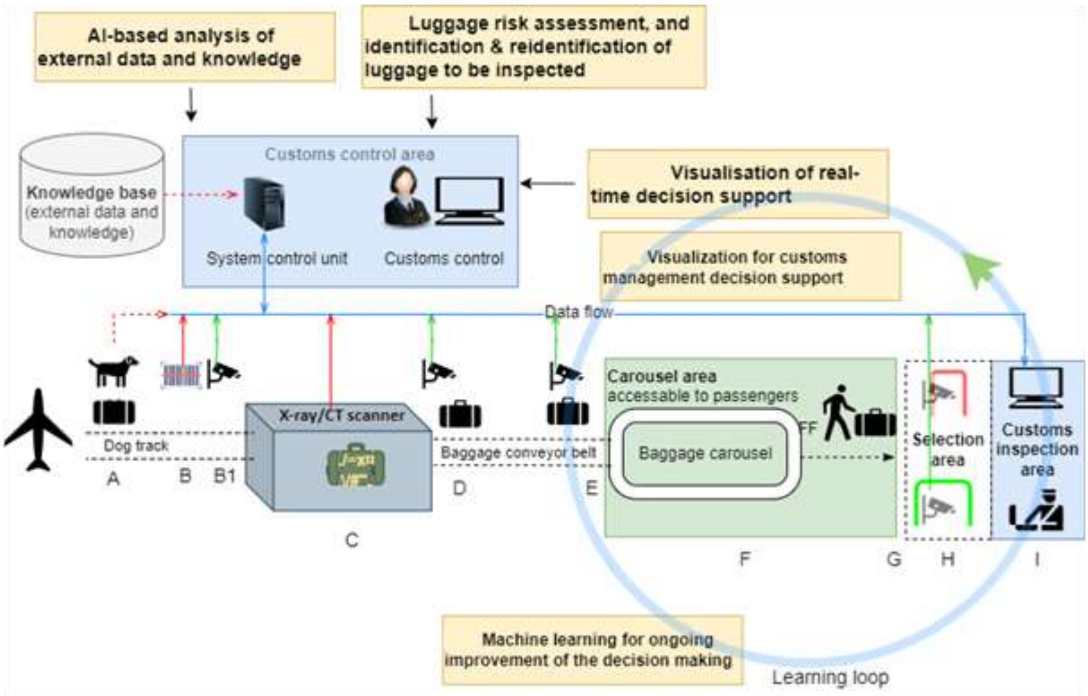

Figure 3: Operations pipeline of BAG-INTEL System

The BAG-INTEL system, assists border and custom authorities to detect baggage containing contraband in an effective and real-time manner. BAG-INTEL provides robust AI based information utilization and decision support tools to support the stakeholders of the project (primarily Customs, Police and Airport Operators).

As shown in Figure 3, The BAG-INTEL system is inline with the airport operations pipeline at arrivals area. One of the main subsystems of BAG-INTEL is the **X-ray/CT scanner**. The scanner is enhanced with an AI algorithm for automatic detection of contraband, especially narcotics, in the luggage. The automatic detection of the scanner is complemented by a **Knowledge Decision System** which takes into consideration the risk signal and information from the X-ray/CT scanner as also additional risk indicators, as in the following list:

a. Risk Indicator from External Data (I_i).

b. Risk indicator by the X-ray/CT scanner (I_x).

c. Risk indicator set visually by the customs officer (I_o).

d. Risk indicator from (sniffer) dog handler (I_d).

e. Risk indicator from re-identification data (I_c).

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The Risk Indicator from External Data (I_i) is based on a **Knowledge Management System** that aggregates knowledge from external databases.

An **AI based re-identification sub-system** by using cameras in certain locations along the operations pipeline extracts the signature (features) of a bag to be used for its physical identification, enabling the association of the physical object with its digital profile.

A **User Interface** supports luggage control by the Customs at the inspection point. The User Interface supports the decision of customs to inspect a bag and monitors the entire flow of the bags. It also recognizes the reidentified bags associating them with their digital information.

Consequently, through the BAG-INTEL system, at Customs area, Customs Officers have the physical view of a bag associated with its digital risk profile for containing narcotics or not and other relevant information, thus assisting Custom Authorities to detect baggage containing contraband rapidly, effectively and efficiently which is the main goal of BAG-INTEL.

For the continuous improvement of the effectiveness of the BAG-INTEL system, a User Interface allows Customs to provide information on the effectiveness of the BAG-INTEL system. The feedback is used by the **Machine Learning tools for the Continuous improvement of decision making**.

A **Digital Twin** subsystem runs in parallel with the real-time operations. The Digital Twin replicates the operations of the airports reproducing flows of baggage and people within a 3D virtual environment and assists Customs management for their longer-term planning in terms of Setup (staffing etc.) for the flight arrivals, shifts management, performance reports, and "what-if" simulation for decision support. A list of the BAG-INTEL technologies and their descriptions is provided in section 3.2.

2.2 BUSINESS ENVIRONMENT - GOALS AND OBJECTIVES

Maintaining effective and efficient customs control of passenger baggage is challenging, especially when we take into consideration the substantial growth of the volume of air travellers arriving in inland border airports and the limited human customs resources available.

The BAG-INTEL project addresses this challenge by providing robust AI based information utilization and decision support tools to support customs for increased effectiveness and efficiency of the customs control of air traveller baggage in inland border airports, while minimizing the human customs resources needed.

The project has the following objectives supported by the StRS document:

Objective 1: To create and demonstrate an effective AI-camera based luggage reidentification solution.

Objective 2: To create and demonstrate the AI enhanced detection and recognition of contraband in the scanning images of the luggage by using an appropriate set of indicators.

Objective 3: To create and demonstrate a digital twin of the BAG-INTEL system.

Objective 4: To successfully demonstrate the effectiveness and efficiency of the complete BAG-INTEL system real Use Cases.

Objective 5: To ensure wide communication and scientific dissemination of the innovative BAG-INTEL results.

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3 USER REQUIREMENTS AND SCENARIOS

3.1 OVERVIEW OF THE USE CASES

Three use cases have been defined that will test and pilot the BAG-INTEL system. Use Case 1 will be demonstrated at the Billund Airport, Denmark (small international airport), Use Case 2 will be demonstrated at the Thessaloniki airport 'Makedonia', Greece (medium sized international airport) and Use Case 3 will be demonstrated at the Adolfo Suárez Madrid–Barajas Airport, Spain (large international airport).

In this first version of the document, six (6) scenarios for the three (3) Use Cases of BAG-INTEL have been developed by the primary stakeholders of the respective three (3) pilots, i.e. Billund Airport, Denmark (small international airport), Thessaloniki Airport 'Makedonia', Greece (medium international airport) and Adolfo Suárez Madrid–Barajas Airport, Spain (large international airport) (sections 3.6, 3.7, 3.8).

Additional scenarios will be developed during the project, including requirements related to the Digital Twin subsystem of BAG-INTEL, and will be included in the second and final version of the document (D2.2 M32).

The scenarios have been customized based on the requirements of each airport. This is also related to the customization of the BAG-INTEL sub-systems. Due to the large shipping and operational costs and the time constraints for shipping the X-ray/CT scanner to all three airports, it was decided by the BAG-INTEL consortium that only the Billund Airport, Denmark will be hosting the X-ray/CT scanner physically, while the other two airports will be testing the BAG-INTEL system through simulated signals which will be generated by the X-ray/CT scanner for the different scenarios. This way the X-ray/CT scanner will be simulated for the two airports with the process being transparent for the rest of the sub-systems of BAG-INTEL during its end-to-end demonstration.

The main differentiation of each Use Case, is the experience they will be receiving in their respective scenarios with the different levels of ability of the BAG-INTEL system for automatic detection of different categories of narcotics having different chemical structures, at different quantities, concealed in different ways. ***As the ability of the AI algorithms of the X-ray/CT scanner to recognize narcotics, will be developed for the first time, such detection will be the first time to be achieved in a real airport-operations setting.***

Thus Billund Airport, Denmark will be demonstrating the ability of the BAG-INTEL system to detect ("hash" – Contraband X), Thessaloniki Airport 'Makedonia', Greece to detect ("brown heroin" – Contraband Y) and Adolfo Suárez Madrid–Barajas Airport, Spain to detect ("Cocain" – Contraband Z).

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3.2 BAG-INTEL TECHNOLOGIES TO BE USED BY THE USE CASES

The following BAG-INTEL technologies will be tested by the Use Cases:

1. **Knowledge Management System:** A knowledge management system that aggregates knowledge from external databases while applying the privacy and security recommendations developed within the context of the project.

2. **Digital Twin:** A Digital Twin, replicating the operations of the airports, reproducing flows of baggage and people within a 3D virtual environment. The digital twin will support customs management through simulation (what-if) scenarios.

3. **X-Ray analysis Algorithm:** An algorithm for automatic detection of contraband in bags to be developed by using the X-Ray images.

4. **AI Re-identification sub-system:** An AI based re-identification sub-system which by using cameras in certain locations along the operations pipeline (Figure <Fig:>) extracts the signature (features) of a bag to be used for its physical identification, enabling the association of the physical object with its digital profile.

5. **Global Risk Indicator Mathematical Model:** Definition of the mathematical model and algorithm to generate a Global Risk Indicator (I_G) based on the following basic risk indicators :

    a. Risk Indicator from External Data (I_i).

    b. Risk indicator by the X-ray/CT scanner (I_x).

    c. Risk indicator set visually by the customs officer (I_o).

    d. Risk indicator from (sniffer) dog handler (I_d).

    e. Risk indicator from re-identification data (I_c).

6. **Knowledge Decision System:** A Knowledge Decision system that takes into consideration the Global Risk Indicator (I_G) as also the following basic risk indicators in order to provide real-time decision support to the Customs operations:

    a. Risk Indicator from External Data (I_i).

    b. Risk indicator by the X-ray/CT scanner (I_x).

    c. Risk indicator set visually by the customs officer (I_o).

    d. Risk indicator from (sniffer) dog handler (I_d).

    e. Risk indicator from re-identification data (I_c).

7. **User Interface. Real-Time Visualization for Decision Support – Decision to Inspect a Bag:** A User Interface that supports luggage control by the Customs at the inspection point. The User Interface utilizes the Knowledge Decision system taking into consideration the Global Risk Indicator as also the basic risk indicators. The User Interface provides visualization in order to support real-time decision of whether to inspect a bag. It provides the connection between

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the traveller and the luggage carried, allowing the customs to check that the traveller inspected shows all, and only, the bags checked-in for this traveller.

8. **User Interface. Real-Time Visualization for Decision Support – Monitoring the entire flow of the bags:** A User Interface that supports luggage control by the Customs by monitoring the entire flow of the bags.

9. **User Interface. Real-Time Decision Support for Customs – Recognition of reidentified bags:** A User Interface that supports luggage control by the customs, by recognizing the automatically reidentified bags at customs place.

10. **User Interface. Real-Time Decision Support for Customs – Feedback by Customs:** A User Interface that allows customs to provide information on the effectiveness of the BAG-INTEL system. The feedback provides feedback for the learning loop system.

11. **Machine Learning tools for Continuous improvement of decision making:** A set of Machine learning algorithms will be used in order to perform continuous improvement of the BAG-INTEL system.

Figure 4, presents the BAG-INTEL technologies used by the Use Case Scenarios developed. Scenarios for Digital Twins will be developed during the project and will be included in the second and final version of this document (Deliverable D2.2 M32).

	Use Case 1 (small international airport): Billund Airport, Denmark		Use Case 2 (medium international airport): Thessaloniki Airport 'Makedonia', Greece		Use case 3 (large international airport): Adolfo Suárez Madrid-Barajas Airport, Spain	
BAG - INTEL Technologies	UC1_SCE_BLL_01	UC1_SCE_BLL_02	UC1_SCE_MAK_01	UC1_SCE_MAK_02	UC1_SCE_MAD_01	UC1_SCE_MAD_02
Knowledge Management System		X		X		X
Digital Twin (to be used in the second/final version of the document)						
X-Ray analysis Algorithm	X	X	X	X	X	X
AI Re-identification sub-system	X	X	X	X	X	X
Global Risk Indicator Mathematical Model	X	X	X	X	X	X
Knowledge Decision System	X	X	X	X	X	X
User Interface. Real-Time Visualization for Decision Support - Decision to Inspect a Bag	X	X	X	X	X	X
User Interface. Real-Time Visualization for Decision Support - Monitoring the entire flow of the bags						
User Interface. Real-Time Decision Support for Customs - Recognition of reidentified bags	X	X	X	X	X	X
User Interface. Real-Time Decision Support for Customs - Feedback by Customs	X	X	X	X	X	X
Machine Learning tools for Continuous improvement of decision making	X	X	X	X	X	X

Figure 4: BAG-INTEL Technologies used by the Use Case scenarios

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Stakeholder Requirements		BAG-INTEL Technologies										
Stakeholder Requirement ID	Stakeholder Requirement Description	Knowledge Management System	Digital Twin	X-Ray analysis Algorithm	AI Re-identification sub-system	Global Risk Indicator Mathematical Model	Knowledge Decision System	User Interface. Real-Time Visualization for Decision Support – Decision to Inspect a Bag	User Interface. Real-Time Visualization for Decision Support – Monitoring the entire flow of the bags	User Interface. Real-Time Decision Support for Customs – Recognition of reidentified bags	User Interface. Real-Time Decision Support for Customs – Feedback by Customs	Machine Learning tools for Continuous improvement of decision making
REQ_STK_01.01	The development of a knowledge management system to support the end-user requirements of the project, providing knowledge from external databases while applying the privacy and security recommendations.	X										
REQ_STK_02.01	Digital Twin		X									
REQ_STK_03.01	Image recording of contraband			X								
REQ_STK_04.01	Development of an algorithm for automatic detection of contraband in bags by using the X-Ray images of REQ_STK_03.01. Generation of the Risk indicator by the X-ray/CT scanner (I).			X		X	X					
REQ_STK_05.01	Camera-based signature extraction from a bag.				X							
REQ_STK_05.02	Camera-based re-identification of a bag.				X							
REQ_STK_05.03	Association of the "Physical Bag Identification" with the unique "Global Identification" of the entity in the integrated system.				X							
REQ_STK_05.04	Support to resolve extraordinary incidents that may take place at the airport.				X							
REQ_STK_06.01	Derivation of the Risk Indicator from External Data Sources (I).	X				X	X					
REQ_STK_06.02	Derivation of the Risk Indicator from Customs Officer (I).					X	X					
REQ_STK_06.03	Derivation of the Risk Indicator from (sniffer) dog handler (I).					X	X					
REQ_STK_07.01	Definition of Contraband Presence Risk Indicators					X	X					
REQ_STK_07.02	Definition of the mathematical model and algorithm of the Global Risk Indicator					X	X					
REQ_STK_07.03	Generation of a single Global Risk Indicator based on multiple Basic Risk Indicators.					X						
REQ_STK_07.04	Improvement of the Risk Indication of the x-ray/CT scanner (I) by using the rest of the derived Basic Risk Indicators and Global Risk Indicator (I).			X		X	X					
REQ_STK_08.01	User Interface for Risk Based Decision - Real-Time Decision Support for Customs							X				
REQ_STK_08.02	Visualization, Monitoring the entire flow of bags - Real-Time Decision Support for Customs								X			
REQ_STK_08.03	GUI for Reidentification - Real-Time Decision Support for Customs									X		
REQ_STK_08.04	GUI for Feedback - Real-Time Decision Support for Customs										X	
REQ_STK_09.01	Customs Management: Decision support through simulation and visualization		X									
REQ_STK_10.02	Continuous improvement of the decision making through Machine Learning											X

Figure 5: Technologies associated with Stakeholder Requirements

Figure 5, presents the association between the Stakeholder Requirements reported in section 3.5 of this document and the BAG-INTEL technologies.

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3.3 BAG-INTEL SWIMLANE DIAGRAM (UML)

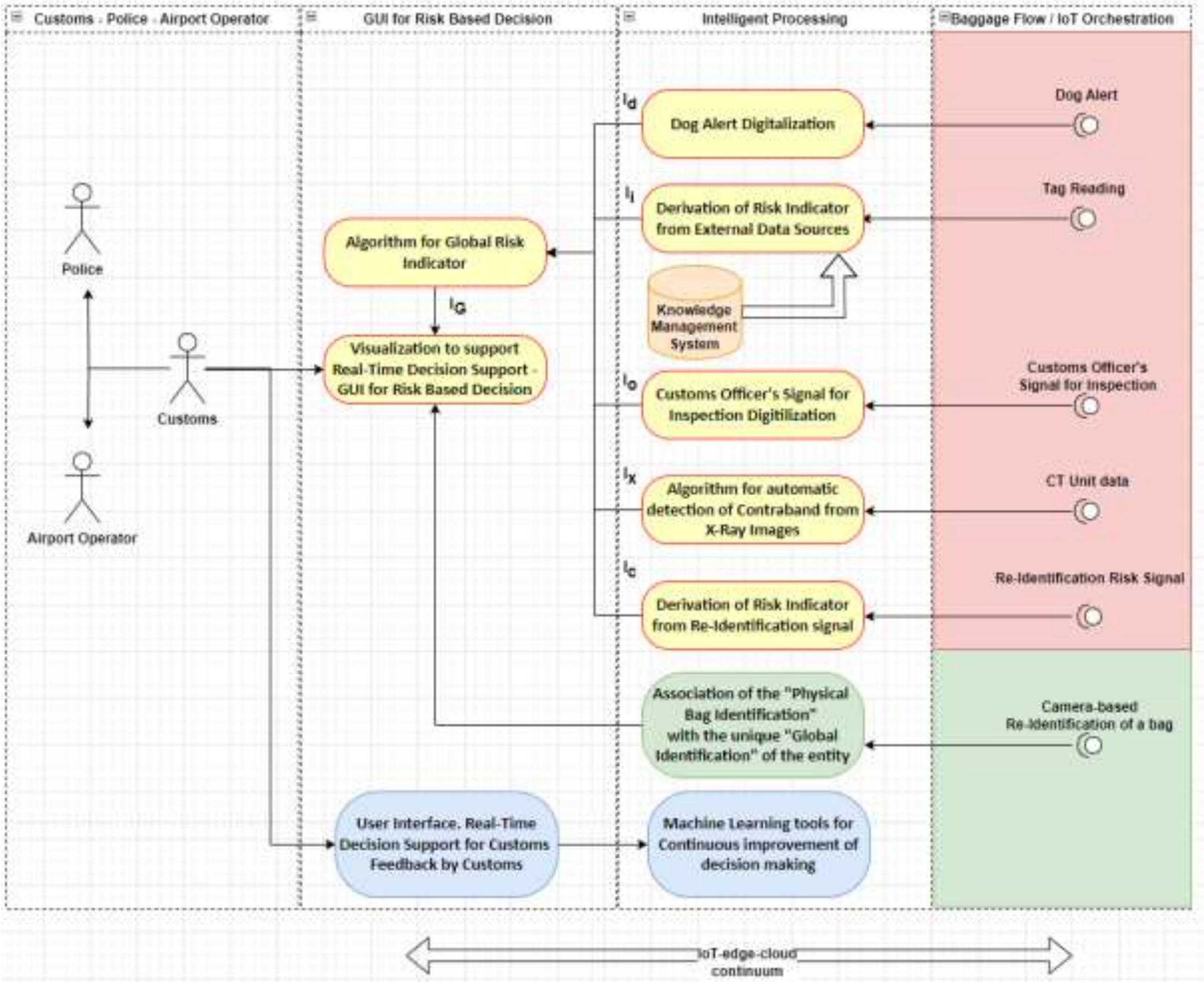

Figure 6: Swimlane Diagram (UML) of the BAG-INTEL Real-Time Operations Pipeline

Based on the conceptual model of the operations of the BAG-INTEL system (presented in section 2.1), a UML swimlane diagram has been generated as presented in Figure 6.

The four swimlane activity rectangles (Baggage Flow/ IoT Orchestration, Intelligent Processing, GUI for Risk Based Decision and Customs-Police-Airport Operator) model the flow of activities taking place in real-time as a bag flows along the BAG-INTEL system. Each Use Case scenario presented in sections 3.6.4, 3.7.4 will be referring to this general Swimlane Diagram, using partly its activities depending on the scenario.

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3.4 BAG-INTEL SYSTEM CUSTOMIZATION FOR EACH USE CASE

The existence of three pilot sites associated respectively with three Use Cases allows the project to customize different BAG-INTEL features to different end-user requirements based on the operational requirements and availability of options for each airport.

During the 2nd Plenary Meeting of the project, which took place at Adolfo Suárez Madrid–Barajas Airport, Spain, discussions presented the different options and constraints that exist for each airport depending mainly on the nature and type of the existing operational infrastructure in place at each airport, on the legal requirements/processes per country and airport, and on the flexibility of each airport, Law Enforcement Agencies of each EU country (LEAs) to make available different categories of contraband for training and testing of the AI algorithms of the BAG-INTEL system. The result of the discussion is a Pilot Customization matrix, which presents the different available sub-systems of the whole BAG-INTEL system, and their availability based on the customization by each pilot. This Pilot Customization matrix is presented in Figure 7.

Due to the large shipping and operational costs and the time constraints for shipping the X-ray/CT scanner to all three airports, it was decided by the BAG-INTEL consortium that only the Billund Airport, Denmark will be hosting the X-ray/CT scanner physically, while the other two airports will be testing the BAG-INTEL system through simulated signals which will be generated by the X-ray/CT scanner for the different scenarios. This way the X-ray/CT scanner will be simulated for the two airports with the process being transparent for the rest of the sub-systems of BAG-INTEL during its end-to-end demonstration. The above information is shown in Figure 7 as "CT SCANNER (PHYSICALLY AT LOCATION)" for Use Case 1: Billund Airport, Denmark, while for the remaining two pilots the diagram reports "VIRTUAL (SIMULATED) CT SCANNER".

USE CASE	DOG TRACK OR SIMULATED DOG DIGITALIZED SIGNAL WITHIN CHAIN OF OPERATIONS	TAG READER FOR EXTERNAL KNOWLEDGE OR SIMULATED EXTERNAL KNOWLEDGE WITHIN CHAIN OF OPERATIONS	CAMERA - RE-IDENTIFICATION SYSTEM	CT SCANNER OR VIRTUAL (SIMULATED) CT SCANNER WITHIN CHAIN OF OPERATIONS
UC1: BILLUND AIRPORT, DENMARK	SIMULATED	SIMULATED	YES	CT SCANNER (PHYSICALLY AT LOCATION)
UC2: THESSALONIKI AIRPORT MAKEDONIA, GREECE	SIMULATED	YES	YES	VIRTUAL (SIMULATED) CT SCANNER
UC3:ADOLFO SUÁREZ MADRID–BARAJAS AIRPORT, SPAIN	SIMULATED	YES	YES	VIRTUAL (SIMULATED) CT SCANNER

Figure 7: Pilot Customization Matrix

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3.5 STAKEHOLDER REQUIREMENTS

This section presents a list of stakeholder requirements which have been gathered during the elicitation phase.

Based on the ISO/IEC/IEEE 29148:2011 standard and at the level of applicability to the gathered requirements in this document, we provide below some clarifications on the attributes associated with the stakeholder requirements. Especially for the definition of priority, the "MoSCoW" method was employed when describing functional requirements (where the keywords 'must', 'should', 'could' mapping to high, medium, and low priority respectively). This approach was followed to distinguish which features are most important, which can be considered, and which would be nice to have but not necessary in a clear, structured manner.

- **Priority:** The attribute "Priority" of each requirement follows the following scale: 1 (Low Priority), 2 (Medium Priority), 3 (High Priority).
- **Type:** The attribute "Type" can be:
    - **Functional**, describing the system or system element functions or tasks to be performed.
    - **Non-Functional**, describing mostly quality requirements and human factors.
    - **Performance**, describing quantitative requirements of system performance.
    - **Interface**, interface with external systems.

Table 2: Stakeholder Requirement REQ_STK_01.01

Section	Description
ID	**REQ_STK_01.01**
Title	The development of a knowledge management system to support the end-user requirements of the project, providing knowledge from external databases while applying the privacy and security recommendations.
Description/ Rationale	A knowledge management system must be tuned up, taking into account the analysis of end-user requirements and the provided knowledge from external databases and end-users while applying the privacy and security recommendations developed within the context of the project. The base of the stored knowledge is a triple store server to manage ontological data represented as triples to store an ontology built upon the data and information flows coming from customs, alerts, passengers' information, image reidentification, customs and system decisions, etc., satisfying all the security and privacy aspects.

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Objectives	Manage external data for the development of intelligence which can be used by the Bag-Intel system for the derivation of a Risk Indicator (Risk Indicator from External Data Sources).
Type	Functional
Priority	High (3)
Pre-Conditions	Availability of External Data by the respective Data Owners (Authorities) Legal and Ethical assessment of the external data to be used.
Legal and Ethical requirements	In the production system, the Knowledge Management System will include personal data, thus legal and ethical requirements deriving from GDPR and AI Act will be taken into consideration. Thus, for the purposes of the BAG-INTEL research project, synthetic data or anonymized data will be used.
Security and Safety requirements	Pre-processing of data before these are inserted into the Knowledge Management System in order to conform to privacy, security and safety regulations.
Frequency of Use	Per bag on the baggage belt for multiple flights per day.
Performance	Real-Time performance following the flow of the bags on the belt. Note: For the Use Case scenarios of this research project performance may not reach real-time.
Primary Actors	Customs Officers
Channels to Primary Actors	Via Customs User Interface (Requirement: REQ_STK_08.01)
Secondary Actors	Knowledge Management System Administrators, External Data Owners (Authorities).
Channels to Secondary Actors	Knowledge Management System APIs. Data filters pipeline from External Data Sources - Cross Cloud data filters from Government Cloud (High Security) to Airport Cloud at the edge (High Security).
Success Criteria	An operational Knowledge Management System for external data which can be used by the Bag-Intel system for the derivation of a Risk Indicator (Risk Indicator from External Data Sources).
Dependencies	None
Reference Use Case	Refer to Requirements Traceability Matrix

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Expected delivery date	M32
Source	Collaborative elicitation process for WP2.4
Technically Reviewed by	Respective Technical Partners for WP2.4
Agreed with:	**Billund Airport, DK:** TOLD **Thessaloniki Airport "Makedonia", GR:** IAPR, FG **Adolfo Suárez Madrid–Barajas Airport, ES:** GUCI, AEAT **Estonian Tax and Customs Board:** ETCB

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Table 3: Stakeholder Requirement REQ_STK_02.01

Section	Description
ID	**REQ_STK_02.01**
Title	Digital Twin
Description/ Rationale	A digital twin must replicate the operations of the airports, reproducing flows of baggage and people, within a 3D virtual environment. The digital twin will be developed based on statistical and historical data and, if possible, based on the collection of data on-site.
Objectives	Development of the digital twin with the aim of supporting the end-user during the decision-making phase, by providing visual aid of the airport/BMS.
Type	Functional
Priority	High (3)
Pre-conditions	Available airport data.
Legal and Ethical Requirements	The dataset does not include sensitive data or information subject to specific ethical and/or legal requirements.
Security and Safety requirements	The Digital Twin replicates part of airport operations. The data received as input and the data generated are airport specific, thus they must be treated with confidentiality. Data and simulations remain within the highly secure "Airport Cloud at the edge".
Frequency of Use	Multiple times per month. Acquired data will be used for the creation of the digital twins, any time the simulation is run, the base data will be exploited.
Performance	No need for real-time performance.
Primary Actors	Customs Officers, Airport Operator
Channels to Primary Actors	Via Digital Twin User Interface (Requirement: REQ_STK_09.01)
Secondary Actors	Digital Twin Administrators
Channels to Secondary Actors	N/A
Success Criteria	Fully operational Digital Twin subsystem.
Dependencies	None
Reference Use Case	Refer to Requirements Traceability Matrix

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Expected delivery date	M36
Source	Collaborative elicitation process for WP2.6
Technically Reviewed by	Respective Technical Partners for WP2.6
Agreed with:	**Billund Airport, DK:** TOLD **Thessaloniki Airport "Makedonia", GR:** IAPR, FG **Adolfo Suárez Madrid–Barajas Airport, ES:** GUCI, AEAT **Estonian Tax and Customs Board:** ETCB

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Table 4: Stakeholder Requirement REQ_STK_03.01

Section	Description
ID	**REQ_STK_03.01**
Title	Image recording of contraband
Description/ Rationale	In cooperation with Customs and based on a list of available contraband categories and their importance (information available from the project characterised as sensitive), image recording of contraband must be performed associated with ground truth annotation, in order to support X-Ray risk assessment.
Objectives	Image recording of contraband in order to suport X-Ray risk assessment.
Type	Functional
Priority	High (3)
Pre-conditions	Availability of contraband to be recorded for the project, by Customs and EU Law Enforcement Agencies.
Legal and Ethical Requirements	No particular legal and ethical requirements.
Security and Safety requirements	Availability of contraband should follow all legal processes including contraband custody requirements.
Frequency of Use	Will take place at the beginning of the project.
Performance	The process spans multiple days.
Primary Actors	Customs, LEAs
Channels to Primary Actors	Legislation, processes defined by EU and national law and respective regulations.
Secondary Actors	X-Ray CT scanner Administrators
Channels to Secondary Actors	Custody processes by LEAs
Success Criteria	Successful image recording of contraband, associated with ground truth annotation.

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Dependencies	Operational dependencies which require co-location of X-Ray CT scanner with available contraband in custody.
Reference Use Case	Refer to Requirements Traceability Matrix
Expected delivery date	M18
Source	Collaborative elicitation process for WP3.1
Technically Reviewed by	Respective Technical Partners for WP3.1
Agreed with:	**Billund Airport, DK:** TOLD **Thessaloniki Airport "Makedonia", GR:** IAPR **Adolfo Suárez Madrid–Barajas Airport, ES:** GUCI, AEAT **Estonian Tax and Customs Board:** ETCB

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Table 5: Stakeholder Requirement REQ_STK_04.01

Section	Description
ID	**REQ_STK_04.01**
Title	Development of an algorithm for automatic detection of contraband in bags by using the X-Ray images of REQ_STK_03.01. Generation of the Risk indicator by the X-ray/CT scanner (I_x).
Description/ Rationale	The algorithm/procedure must produce risk indicators indicating the presence of suspicious baggage as also information about the identified contraband. The parameters obtained will be combined to allow high probability of detection in combination with low false alarm rate.
Objectives	An algorithm to generate the Risk indicator by the X-ray/CT scanner (I_x) indicating the presence of suspicious baggage including information about the identified contraband.
Type	Functional
Priority	High (3)
Pre-conditions	Existence of X-Ray images from requirements REQ_STK_03.01.
Legal and Ethical Requirements	No particular legal and ethical requirements.
Security and Safety requirements	No particular legal and ethical requirements.
Frequency of Use	Per bag on the baggage belt for multiple flights per day.
Performance	Real-Time performance following the flow of the bags on the belt.
Primary Actors	Customs Officers
Channels to Primary Actors	Via Customs User Interface (Requirement: REQ_STK_08.01)
Secondary Actors	X-Ray CT scanner Administrators
Channels to Secondary Actors	X-Ray CT scanner subsystem
Success Criteria	Generation of a correct and effective algorithm

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Dependencies	Requirement REQ_STK_03.01
Reference Use Case	Refer to Requirements Traceability Matrix
Expected delivery date	M34
Source	Collaborative elicitation process for WP3.2
Technically Reviewed by	Respective Technical Partners for WP3.2
Agreed with:	**Billund Airport, DK:** TOLD **Thessaloniki Airport “Makedonia”, GR:** IAPR **Adolfo Suárez Madrid–Barajas Airport, ES:** GUCI, AEAT **Estonian Tax and Customs Board:** ETCB

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Table 6: Stakeholder Requirement REQ_STK_05.01

Section	Description
ID	**REQ_STK_05.01**
Title	Camera-based signature extraction from a bag.
Description/ Rationale	Camera-based extraction of the signature (features) must be used for physical identification of a "bag" based on AI technology, enabling the association of the physical object with its digital profile.
Objectives	To extract a signature form a bag in order to be used for its physical identification.
Type	Functional
Priority	High (3)
Pre-conditions	Training of the re-identification sub-system.
Legal and Ethical Requirements	Personal Data may be present. The bag tag label that is attached on a luggage has printed on it the passenger name, thus legal and ethical issues exist. For this reason and for the purposes of the BAG-INTEL project, synthetic data and anonymized data will be used.
Security and Safety requirements	No particular security or safety requirements.
Frequency of Use	Per bag on the baggage belt for multiple flights per day.
Performance	Real-Time performance following the flow of the bags on the belt. Note: For the Use Case scenarios of this research project performance may not reach real-time.
Primary Actors	Customs Officers
Channels to Primary Actors	Via Customs User Interface (Requirement: REQ_STK_08.01)
Secondary Actors	Re-identification sub-system administrators
Channels to Secondary Actors	Re-identification sub-system
Success Criteria	Effective identification/re-identification of bags.
Dependencies	None
Reference Use Case	Refer to Requirements Traceability Matrix

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Expected delivery date	M34
Source	Collaborative elicitation process for WP3.3
Technically Reviewed by	Respective technical partners for WP3.3
Agreed with:	**Billund Airport, DK:** TOLD **Thessaloniki Airport "Makedonia", GR:** IAPR **Adolfo Suárez Madrid–Barajas Airport, ES:** GUCI, AEAT **Estonian Tax and Customs Board:** ETCB

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Table 7: Stakeholder Requirement REQ_STK_05.02

Section	Description
ID	**REQ_STK_05.02**
Title	Camera-based re-identification of a bag.
Description/ Rationale	A bag must be re-identified at Customs - exit area based on the signature (features) extracted by the cameras sub-system, during the previous identification of the "bag".
Objectives	To re-identify a bag at Customs (exit-area) based on a signature extracted during the identification phase.
Type	Functional
Priority	High (3)
Pre-conditions	Training of the re-identification sub-system.
Legal and Ethical Requirements	Personal Data may be present. The bag tag label that is attached on a luggage has printed on it the passenger name, thus legal and ethical issues exist. For this reason and for the purposes of the BAG-INTEL project, synthetic data and anonymized data will be used.
Security and Safety requirements	No particular security or safety requirements.
Frequency of Use	Per bag on the baggage belt for multiple flights per day.
Performance	Real-Time performance following the flow of the bags on the belt. Note: For the Use Case scenarios of this research project performance may not reach real-time especially due to slower performance of AI algorithms.
Primary Actors	Customs Officers
Channels to Primary Actors	Via Customs User Interface (Requirement: REQ_STK_08.01)
Secondary Actors	Re-identification sub-system administrators
Channels to Secondary Actors	Re-identification sub-system
Success Criteria	Effective re-identification of bags.
Dependencies	REQ_STK_05.01

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Reference Use Case	Refer to Requirements Traceability Matrix
Expected delivery date	M34
Source	Collaborative elicitation process for WP3.3
Technically Reviewed by	Respective technical partners for WP3.3
Agreed with:	**Billund Airport, DK:** TOLD **Thessaloniki Airport "Makedonia", GR:** IAPR **Adolfo Suárez Madrid–Barajas Airport, ES:** GUCI, AEAT **Estonian Tax and Customs Board:** ETCB

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Table 8: Stakeholder Requirement REQ_STK_05.03

Section	Description
ID	**REQ_STK_05.03**
Title	Association of the “Physical Bag Identification” with the unique “Global Identification” of the entity in the integrated system.
Description/ Rationale	Physical Bag Identification is one of the “identities” that the system receives from different sub-systems (here the re-identification sub-system). These identities must be linked (associated) with the unique “Global Identification” of the entity in the integrated system.
Objectives	To associate the “Physical Bag Identification” with the unique “Global Identification” of the entity in the integrated system.
Type	Functional
Priority	High (3)
Pre-conditions	None
Legal and Ethical Requirements	None
Security and Safety requirements	None
Frequency of Use	Per bag on the baggage belt for multiple flights per day.
Performance	Real-Time performance following the flow of the bags on the belt. Note: For the Use Case scenarios of this research project performance may not reach real-time.
Primary Actors	Customs Officers
Channels to Primary Actors	Via Customs User Interface (Requirement: REQ_STK_08.01)
Secondary Actors	Re-identification sub-system administrators, Integrated System administrators
Channels to Secondary Actors	Re-identification sub-system, Integrated software platform.
Success Criteria	Establishment of an 1-1 relationship between the “Physical Bag Identification” with the unique “Global Identification” of the system.

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Dependencies	Requirement REQ_STK_05.01.
Reference Use Case	Refer to Requirements Traceability Matrix
Expected delivery date	M34
Source	Collaborative elicitation process for WP3.3
Technically Reviewed by	Respective technical partners for WP3.3
Agreed with:	**Billund Airport, DK:** TOLD **Thessaloniki Airport "Makedonia", GR:** IAPR **Adolfo Suárez Madrid–Barajas Airport, ES:** GUCI, AEAT **Estonian Tax and Customs Board:** ETCB

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Table 9: Stakeholder Requirement REQ_STK_05.04

Section	Description
ID	**REQ_STK_05.04**
Title	Support to resolve extraordinary incidents that may take place at the airport.
Description/ Rationale	Images and video should be provided to customs upon request from the re-identification cameras (e.g. in case of extraordinary incidents - not in real-time).
Objectives	Usage of the information received from the re-identification cameras sub-system (images, video) in the case of extraordinary incidents that may take place at the airport. The information will be used in order to support airport authorities' efforts in resolving these incidents.
Type	Process Requirement.
Priority	Medium (2)
Pre-conditions	Existence of a re-identification sub-system.
Legal and Ethical Requirements	Some personal data that appear on images and video may need to be obscured.
Security and Safety requirements	Screening of the video, images will be performed for any information that may need to be obscured/removed that could compromise security and safety.
Frequency of Use	Upon extraordinary incidents.
Performance	N/A
Primary Actors	Customs Officers
Channels to Primary Actors	System
Secondary Actors	Re-identification sub-system administrators, Integrated System administrators
Channels to Secondary Actors	System
Success Criteria	To provide useful additional information that can help resolve extraordinary incidents that may happen at the airport.
Dependencies	Requirement REQ_STK_05.01, Requirement REQ_STK_05.02 .
Reference Use Case	Refer to Requirements Traceability Matrix

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Expected delivery date	M34
Source	Collaborative elicitation process for WP3.3
Technically Reviewed by	Respective technical partners for WP3.3
Agreed with:	**Billund Airport, DK:** TOLD **Thessaloniki Airport "Makedonia", GR:** IAPR, FG **Adolfo Suárez Madrid–Barajas Airport, ES:** GUCI, AEAT **Estonian Tax and Customs Board:** ETCB

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Table 10: Stakeholder Requirement REQ_STK_06.01

Section	Description
ID	**REQ_STK_06.01**
Title	Derivation of the Risk Indicator from External Data Sources (I_i).
Description/ Rationale	Based on information received from Internal Data Sources, the respective Risk Indicator (I_i) must be derived. Within this context the following analysis will be performed: • Establishing connection between the owner of the luggage and known drugs-related crime groups. • Analyzing the passenger's travel pattern: Does it appear to be illogical or in other ways suspicious? • Analyzing return flights at an unduly close interval, possibly combined with a large difference in the weight of the traveller's luggage. • Analyzing passenger's behaviour, based on PNR/PIU information: For instance, unusual form of payment (e.g., buying the ticket and paying with cash short time before departure), or buying the ticket at a suspect travel agency.
Objectives	Derive the Risk Indicator from External Data Sources.
Type	Functional
Priority	High (3)
Pre-conditions	Availability of a Knowledge Management System that will be storing and managing data from external data sources.
Legal and Ethical Requirements	For the purposes of the project, synthetic data will be used.
Security and Safety requirements	For the purposes of the project, synthetic data will be used.
Frequency of Use	Per bag on the baggage belt for multiple flights per day.
Performance	Real-Time performance following the flow of the bags on the belt.
Primary Actors	Customs Officers
Channels to Primary Actors	Via Customs User Interface (Requirement: REQ_STK_08.01)

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Secondary Actors	Knowledge Management System administrators, Risk Indicator from External Data Sources module administrators
Channels to Secondary Actors	System
Success Criteria	An effective Risk Indicator from External Data Sources which can be used for the generation of the Global Risk Indicator.
Dependencies	REQ_STK_01.01
Reference Use Case	Refer to Requirements Traceability Matrix
Expected delivery date	M16
Source	Collaborative elicitation process for WP4.1
Technically Reviewed by	Respective technical partners for WP4.1
Agreed with:	**Billund Airport, DK:** TOLD **Thessaloniki Airport “Makedonia”, GR:** IAPR, FG **Adolfo Suárez Madrid–Barajas Airport, ES:** GUCI, AEAT **Estonian Tax and Customs Board:** ETCB

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Table 11: Stakeholder Requirement REQ_STK_06.02

Section	Description
ID	**REQ_STK_06.02**
Title	Derivation of the Risk Indicator from Customs Officer (I_o).
Description/ Rationale	A Risk Indicator must be defined based on Customs Officer experience.
Objectives	Derive the Risk Indicator from Customs Officer (I_o).
Type	Functional
Priority	High (3)
Pre-conditions	Customs Officer on duty.
Legal and Ethical Requirements	None
Security and Safety requirements	None
Frequency of Use	Per bag on the baggage belt for multiple flights per day.
Performance	Real-Time performance following the flow of the bags on the belt.
Primary Actors	Customs Officers
Channels to Primary Actors	Via Customs User Interface (Requirement: REQ_STK_08.01)
Secondary Actors	Global Risk module administrators
Channels to Secondary Actors	System
Success Criteria	Effective derivation/digitization of the Risk Indicator from Customs Officer which can be used for the generation of the Global Risk Indicator.
Dependencies	None

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Reference Use Case	Refer to Requirements Traceability Matrix
Expected delivery date	M16
Source	Collaborative elicitation process for WP4.1
Technically Reviewed by	Respective technical partners for WP4.1
Agreed with:	**Billund Airport, DK:** TOLD **Thessaloniki Airport "Makedonia", GR:** IAPR **Adolfo Suárez Madrid–Barajas Airport, ES:** GUCI, AEAT **Estonian Tax and Customs Board:** ETCB

Table 12: Stakeholder Requirement REQ_STK_06.03

Section	Description
ID	**REQ_STK_06.03**
Title	Derivation of the Risk Indicator from (sniffer) dog handler (I_d).
Description/ Rationale	A Risk Indicator must be defined based on the availability of a sniffer dog.
Objectives	Derive the Risk Indicator from a sniffer dog handler (I_d).
Type	Functional
Priority	High (3)
Pre-conditions	Availability of a sniffer dog handler.
Legal and Ethical Requirements	None
Security and Safety requirements	None

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Frequency of Use	Per bag on the baggage belt for multiple flights per day.
Performance	Real-Time performance following the flow of the bags on the belt.
Primary Actors	Customs Officers
Channels to Primary Actors	Via Customs User Interface (Requirement: REQ_STK_08.01)
Secondary Actors	Global Risk module administrators
Channels to Secondary Actors	System
Success Criteria	Effective derivation/digitization of the Risk Indicator from (sniffer) dog handler which can be used for the generation of the Global Risk Indicator.
Dependencies	None
Reference Use Case	Refer to Requirements Traceability Matrix
Expected delivery date	M16
Source	Collaborative elicitation process for WP4.1
Technically Reviewed by	Respective technical partners for WP4.1
Agreed with:	**Billund Airport, DK:** TOLD **Thessaloniki Airport "Makedonia", GR:** IAPR **Adolfo Suárez Madrid–Barajas Airport, ES:** GUCI, AEAT **Estonian Tax and Customs Board:** ETCB

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Table 13: Stakeholder Requirement REQ_STK_07.01

Section	Description
ID	**REQ_STK_07.01**
Title	Definition of Contraband Presence Risk Indicators
Description/ Rationale	The Contraband Detection Means must conclude whether there is potential contraband presence or not.
Objectives	Definition of Contraband Presence Risk Indicators
Type	Functional
Priority	High (3)
Pre-conditions	None
Legal and Ethical Requirements	None
Security and Safety requirements	None
Frequency of Use	Definition
Performance	N/A
Primary Actors	Customs Officers
Channels to Primary Actors	Via Customs User Interface (Requirement: REQ_STK_08.01)
Secondary Actors	Sub-system administrators, Integrated System administrators
Channels to Secondary Actors	System
Success Criteria	An appropriate definition of Contraband Presence Risk Indicators

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Dependencies	None
Reference Use Case	Refer to Requirements Traceability Matrix
Expected delivery date	M34
Source	Collaborative elicitation process for WP4.2
Technically Reviewed by	Respective technical partners for WP4.2
Agreed with:	**Billund Airport, DK:** TOLD **Thessaloniki Airport "Makedonia", GR:** IAPR **Adolfo Suárez Madrid–Barajas Airport, ES:** GUCI, AEAT **Estonian Tax and Customs Board:** ETCB

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Table 14: Stakeholder Requirement REQ_STK_07.02

Section	Description
ID	**REQ_STK_07.02**
Title	Definition of the mathematical model and algorithm of the Global Risk Indicator
Description/ Rationale	Must define a mathematical model and algorithm of the Global Risk Indicator that will take into consideration the following model of Basic Risk Indicators: a. Risk Indicator from External Data (I_i). b. Risk indicator by the x-ray/CT scanner (I_x). c. Risk indicator set visually by the customs officer (I_o). d. Risk indicator from (sniffer) dog handler (I_d). e. Risk indicator from re-identification data (I_c).
Objectives	Definition of the mathematical model and algorithm of the Global Risk Indicator.
Type	Functional
Priority	High (3)
Pre-conditions	None
Legal and Ethical Requirements	None
Security and Safety requirements	None
Frequency of Use	Definition
Performance	N/A
Primary Actors	Customs Officers
Channels to Primary Actors	Via Customs User Interface (Requirement: REQ_STK_08.01)
Secondary Actors	Sub-system administrators, Integrated System administrators
Channels to Secondary Actors	System
Success Criteria	An appropriate definition of Contraband Presence Risk Indicators
Dependencies	None

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Reference Use Case	Refer to Requirements Traceability Matrix
Expected delivery date	M34
Source	Collaborative elicitation process for WP4.2
Technically Reviewed by	Respective technical partners for WP4.2
Agreed with:	**Billund Airport, DK:** TOLD **Thessaloniki Airport "Makedonia", GR:** IAPR **Adolfo Suárez Madrid–Barajas Airport, ES:** GUCI, AEAT **Estonian Tax and Customs Board:** ETCB

Table 15: Stakeholder Requirement REQ_STK_07.03

Section	Description
ID	**REQ_STK_07.03**
Title	Generation of a single Global Risk Indicator based on multiple Basic Risk Indicators.
Description/ Rationale	The following Basic Risk Indicators must be derived/generated by different BAG-INTEL subsystems: f. Risk Indicator from External Data (I_i). g. Risk indicator by the x-ray/CT scanner (I_x). h. Risk indicator set visually by the customs officer (I_o). i. Risk indicator from (sniffer) dog handler (I_d). j. Risk indicator from re-identification data (I_c). A single Global Risk Indicator must be generated through the aggregation of the Basic Risk Indicators.
Objectives	Derivation of a representative single Global Risk Indicator based on multiple Basic Risk Indicators.
Type	Functional
Priority	High (3)
Pre-conditions	Availability of Basic Risk Indicators.

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Legal and Ethical Requirements	None
Security and Safety requirements	None
Frequency of Use	Per bag on the baggage belt for multiple flights per day.
Performance	Real-Time performance following the flow of the bags on the belt.
Primary Actors	Customs Officers
Channels to Primary Actors	Via Customs User Interface (Requirement: REQ_STK_08.01)
Secondary Actors	Sub-system administrators, Integrated System administrators
Channels to Secondary Actors	System
Success Criteria	A representative single Global Risk Indicator based on multiple Basic Risk Indicators to be used for effective decision support.
Dependencies	Requirements REQ_STK_01.01, REQ_STK_03.01, REQ_STK_04.01, REQ_STK_05.01, REQ_STK_05.02, REQ_STK_06.01, REQ_STK_06.02, REQ_STK_06.03.
Reference Use Case	Refer to Requirements Traceability Matrix
Expected delivery date	M34
Source	Collaborative elicitation process for WP4.2
Technically Reviewed by	Respective technical partners for WP4.2
Agreed with:	**Billund Airport, DK:** TOLD **Thessaloniki Airport "Makedonia", GR:** IAPR **Adolfo Suárez Madrid–Barajas Airport, ES:** GUCI, AEAT **Estonian Tax and Customs Board:** ETCB

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Table 16: Stakeholder Requirement REQ_STK_07.04

Section	Description
ID	**REQ_STK_07.04**
Title	Improvement of the Risk Indication of the x-ray/CT scanner (I_x) by using the rest of the derived Basic Risk Indicators and Global Risk Indicator (I_G).
Description/ Rationale	The whole set of Basic Risk Indicators must derive a Global Risk Indicator (I_G) which is expected to improve the Risk Indication of the x-ray/CT scanner.
Objectives	To improve the Risk Indication of the x-ray/CT scanner (I_x) by using the rest of the derived Basic Risk Indicators and Global Risk Indicator (I_G).
Type	Performance
Priority	High (3)
Pre-conditions	None
Legal and Ethical Requirements	None
Security and Safety requirements	None
Frequency of Use	Analysis
Performance	N/A
Primary Actors	Customs
Channels to Primary Actors	Report
Secondary Actors	All Stakeholders
Channels to Secondary Actors	Report
Success Criteria	To have a significant improvement of the Risk Indication generated by the x-ray/CT scanner (I_x) by using the rest of the derived Basic Risk Indicators and Global Risk Indicator (I_G).
Dependencies	REQ_STK_01.01, REQ_STK_03.01, REQ_STK_04.01, REQ_STK_05.01, REQ_STK_05.02, REQ_STK_06.01, REQ_STK_06.02, REQ_STK_06.03.
Reference Use Case	Refer to Requirements Traceability Matrix

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Expected delivery date	M34
Source	Collaborative elicitation process for WP4.1, WP4.2
Technically Reviewed by	Respective technical partners for WP4.1, WP4.2
Agreed with:	**Billund Airport, DK:** TOLD **Thessaloniki Airport "Makedonia", GR:** IAPR **Adolfo Suárez Madrid–Barajas Airport, ES:** GUCI, AEAT **Estonian Tax and Customs Board:** ETCB

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Table 17: Stakeholder Requirement REQ_STK_08.01

Section	Description
ID	**REQ_STK_08.01**
Title	User Interface for Risk Based Decision - Real-Time Decision Support for Customs
Description/ Rationale	The User Interface must provide Real-Time Decision Support for Customs. Visualization must support in close to real-time the decision whether to inspect a bag or not.
Objectives	Provide a convenient and user friendly GUI, to support customs operations close to real-time, especially close to real-time decision making whether to inspect a bag or not.
Type	Functional
Priority	High (3)
Pre-conditions	None
Legal and Ethical Requirements	None
Security and Safety requirements	None
Frequency of Use	Continuous, supporting operations in real-time
Performance	Real-time support of operations
Primary Actors	Customs Officers
Channels to Primary Actors	Graphical User Interface
Secondary Actors	None
Channels to Secondary Actors	None
Success Criteria	A convenient and user friendly GUI, to support customs operations in real-time, especially real-time decision making whether to inspect a bag or not.
Dependencies	REQ_STK_07.03

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Reference Use Case	Refer to Requirements Traceability Matrix
Expected delivery date	M26
Source	Collaborative elicitation process for WP4.3 and respective minutes of meetings within the context of WP4.3 for the specific requirement.
Technically Reviewed by	Respective technical partners for WP4.3
Agreed with:	**Billund Airport, DK:** TOLD **Thessaloniki Airport "Makedonia", GR:** IAPR **Adolfo Suárez Madrid–Barajas Airport, ES:** GUCI, AEAT **Estonian Tax and Customs Board:** ETCB

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Table 18: Stakeholder Requirement REQ_STK_08.02

Section	Description
ID	**REQ_STK_08.02**
Title	Visualization, Monitoring the entire flow of bags - Real-Time Decision Support for Customs
Description/ Rationale	The Visualization must provide Real-Time Decision Support for Customs. Visualization must be showing in close to real-time the entire flow of bags.
Objectives	Provide a convenient and user-friendly Visualization, to support customs operations close to real-time, monitoring the entire flow of bags.
Type	Functional
Priority	High (3)
Pre-conditions	None
Legal and Ethical Requirements	None
Security and Safety requirements	None
Frequency of Use	Continuous, supporting operations in real-time
Performance	Real-time support of operations
Primary Actors	Customs Officers
Channels to Primary Actors	Visualization
Secondary Actors	None
Channels to Secondary Actors	None
Success Criteria	A convenient and user-friendly Visualization, to support customs operations close to real-time, monitoring the entire flow of bags.
Dependencies	REQ_STK_07.03
Reference Use Case	Refer to Requirements Traceability Matrix

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Expected delivery date	M26
Source	Collaborative elicitation process for WP4.3 and respective minutes of meetings within the context of WP4.3 for the specific requirement.
Technically Reviewed by	Respective technical partners for WP4.3
Agreed with:	**Billund Airport, DK:** TOLD **Thessaloniki Airport “Makedonia”, GR:** IAPR **Adolfo Suárez Madrid–Barajas Airport, ES:** GUCI, AEAT **Estonian Tax and Customs Board:** ETCB

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Table 19: Stakeholder Requirement REQ_STK_08.03

Section	Description
ID	**REQ_STK_08.03**
Title	GUI for Reidentification - Real-Time Decision Support for Customs
Description/ Rationale	The GUI must recognize the automatically reidentified bags at customs place
Objectives	Provide a convenient and user friendly GUI, to support customs operations close to real-time. Customs Officers will be able to recognize a physical bag, based on reidentification information.
Type	Functional
Priority	High (3)
Pre-conditions	None
Legal and Ethical Requirements	None
Security and Safety requirements	None
Frequency of Use	Continuous, supporting operations in real-time
Performance	Real-time support of operations
Primary Actors	Customs Officers
Channels to Primary Actors	Graphical User Interface
Secondary Actors	None
Channels to Secondary Actors	None
Success Criteria	A convenient and user-friendly GUI, to support customs operations close to real-time. Customs Officers to be able to recognize a physical bag, based on reidentification information.
Dependencies	REQ_STK_05.02
Reference Use Case	Refer to Requirements Traceability Matrix

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Expected delivery date	M26
Source	Collaborative elicitation process for WP4.3 and respective minutes of meetings within the context of WP4.3 for the specific requirement.
Technically Reviewed by	Respective technical partners for WP4.3
Agreed with:	**Billund Airport, DK:** TOLD **Thessaloniki Airport "Makedonia", GR:** IAPR **Adolfo Suárez Madrid–Barajas Airport, ES:** GUCI, AEAT **Estonian Tax and Customs Board:** ETCB

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Table 20: Stakeholder Requirement REQ_STK_08.04

Section	Description
ID	**REQ_STK_08.04**
Title	GUI for Feedback - Real-Time Decision Support for Customs
Description/ Rationale	The GUI must fast register the result of any bag inspection performed
Objectives	Provide a convenient and user friendly GUI, to support customs operations close to real-time. Customs Officers will be able to fast register the result of any bag inspection performed.
Type	Functional
Priority	High (3)
Pre-conditions	None
Legal and Ethical Requirements	None
Security and Safety requirements	None
Frequency of Use	Continuous, supporting operations in real-time
Performance	Real-time support of operations
Primary Actors	Customs Officers
Channels to Primary Actors	Graphical User Interface
Secondary Actors	None
Channels to Secondary Actors	None
Success Criteria	A convenient and user-friendly GUI, to support customs operations close to real-time. Customs Officers will be able to fast register the result of any bag inspection performed.

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Dependencies	
Reference Use Case	Refer to Requirements Traceability Matrix
Expected delivery date	M26
Source	Collaborative elicitation process for WP4.3 and respective minutes of meetings within the context of WP4.3 for the specific requirement.
Technically Reviewed by	Respective technical partners for WP4.3
Agreed with:	**Billund Airport, DK:** TOLD **Thessaloniki Airport "Makedonia", GR:** IAPR **Adolfo Suárez Madrid–Barajas Airport, ES:** GUCI, AEAT **Estonian Tax and Customs Board:** ETCB

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Table 21: Stakeholder Requirement REQ_STK_09.01

Section	Description
ID	**REQ_STK_09.01**
Title	Customs Management: Decision support through simulation and visualization.
Description/ Rationale	On the basis of the Digital Twins, a decision support system for Customs Management must be developed. Customs management must be supported through simulation (what-if scenarios) and visualization, to decide on the following aspects: • Setup (staffing, etc.) for the flight arrivals. • Customs shifts management. Scheduling (long and short term) officers on duty, to avoid cases of unfortunate understaffing and overstaffing. • Performance reports to the customs management. • What-if simulation for decision support, such as visualization of the customs control performance and the passenger throughput if, for instance, the risk threshold is decreased or the customs staff on duty is increased. The requirement depends on the strong foundation which must be built from requirement REQ_STK_02.01 and necessary data, such as personnel and passenger traffic data. Digital twins developed in REQ_STK_02.01 must be integrated with a GUI that will enable end-users to use the simulation models as decision support tools.
Objectives	Provide a convenient and user friendly GUI, to support customs management to decide on the specific aspects through simulation (what-if scenarios) and visualization.
Type	Functional
Priority	High (3)
Pre-conditions	Provision of necessary data, such as personnel and passenger traffic data.
Legal and Ethical Requirements	Where necessary, synthetic data or anonymized data will be used.
Security and Safety requirements	Digital Twin model and data to be treated as sensitive, confidential information as it models part of airport operations.
Frequency of Use	Long Term management and planning of airport operations. The models developed in REQ_STK_02.01 will be updated integrating a GUI that will allow end

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	users to make what-if scenario simulations. Acquired data will be used for the creation of the digital twins, any time the simulation is run, the base data will be exploited.
Performance	Long term support of operations
Primary Actors	Airport Operators
Channels to Primary Actors	Digital Twin Graphical User Interface
Secondary Actors	Customs Officers, Police
Channels to Secondary Actors	Digital Twin Graphical User Interface
Success Criteria	Development of a functional visualisation for system support for customs, with accurate data. A convenient and user-friendly GUI, to support long term customs management to decide on the specific aspects through simulation (what-if scenarios) and visualization.
Dependencies	REQ_STK_02.01
Reference Use Case	Refer to Requirements Traceability Matrix
Expected delivery date	M30
Source	Collaborative elicitation process for WP4.4 and respective minutes of meetings within the context of WP4.4 for the specific requirement.
Technically Reviewed by	Respective technical partners for WP4.4
Agreed with:	**Billund Airport, DK:** TOLD **Thessaloniki Airport "Makedonia", GR:** IAPR, FG **Adolfo Suárez Madrid–Barajas Airport, ES:** GUCI, AEAT

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Table 22: Stakeholder Requirement REQ_STK_10.02

Section	Description
ID	**REQ_STK_10.02**
Title	Continuous improvement of the decision making through Machine Learning
Description/ Rationale	Machine learning techniques must be used in order for continuous improvement of the system to be performed. Within this context the system must learn in the loop, performing a continuous learning of the decisions taken by the customs and previous system decisions, whether to inspect a piece of luggage or not.
Objectives	Effective machine learning techniques that will enable the continuous improvement of the accuracy and correctness of the BAG-INTEL system.
Type	Functional
Priority	High (3)
Pre-conditions	Provision of inspection decisions and results from previous bag inspections performed.
Legal and Ethical Requirements	None
Security and Safety requirements	None
Frequency of Use	Systematic learning process in regular cycles.
Performance	Regular learning process.
Primary Actors	System Administrators, Customs Officers
Channels to Primary Actors	Entire BAG-INTEL system.
Secondary Actors	Airport Operators, Police
Channels to Secondary Actors	Entire BAG-INTEL system.
Success Criteria	Improvement of the precision and correctness abilities of the BAG-INTEL system, based on comparison with specific KPIs to be defined.

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Dependencies	REQ_STK_08.04
Reference Use Case	Refer to Requirements Traceability Matrix
Expected delivery date	M34
Source	Collaborative elicitation process for WP4.5 and respective minutes of meetings within the context of WP4.5 for the specific requirement.
Technically Reviewed by	Respective technical partners for WP4.5
Agreed with:	**Billund Airport, DK:** TOLD **Thessaloniki Airport "Makedonia", GR:** IAPR **Adolfo Suárez Madrid–Barajas Airport, ES:** GUCI, AEAT **Estonian Tax and Customs Board:** ETCB

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3.6 USE CASE 1 (SMALL INTERNATIONAL AIRPORT): BILLUND AIRPORT, DENMARK

3.6.1 Goals and Objectives

The Use Case 1 at Billund Airport, Denmark has been selected by the BAG-INTEL partners to physically host the X-ray/CT scanner, due to the large shipping and operational costs and the time constraints for shipping the X-ray/CT scanner to all three airports.

Use Case 1 will be demonstrating the BAG-INTEL system in a small international airport, the Billund Airport in Denmark focusing on the different levels of ability of the BAG-INTEL system for automatic detection of the narcotic “hash” mentioned throughout this document as Contraband X.

While not part of Use Case 1 activity, Billund Airport as it will be hosting X-ray/CT scanner, it will also generate the information to be used by the other two airports through simulation, by scanning contrabands of the narcotic “brown heroin” mentioned throughout the document as Contraband Y and the narcotic “Cocain” mentioned throughout the document as Contraband Z.

Figure 8 presents the customization of the BAG-INTEL system for the needs of Billund Airport. As shown in the figure, the X-ray/CT scanner will be physically at the airport, while the Dog Track and the T\ ag Reader will be simulated. The Re-Identification system will be implemented physically at Billund Airport. Simulations will be supported by the integration software components of the BAG-INTEL system.

The first scenario developed by the Use Case 1 partners, scenario UC1_SCE_BLL_01 presented in section 3.6.2, has as main objective the detection of a medium quantity contraband “Narcotic X” based on risk indicator by the X-ray/CT scanner (I_x). It will also test the efficiency of the Re-identification at Customs area.

The second scenario, developed by the Use Case 1 partners, scenario UC1_SCE_BLL_01 presented in section 3.6.2, addresses the case where intelligence from external data, complements the detection capabilities of the X-ray/CT scanner. In this scenario, a very-small quantity of contraband “Narcotic X” exceeds the limits set by the X-ray/CT scanner and the contraband quantity cannot be detected by the X-ray/CT scanner. Despite this situation, in this scenario, External Data analysis generates a Very-high risk indicator from External Data (I_i) assisting the Customs Officers to decide to inspect the baggage and find the contraband. The scenario will also test the efficiency of the Re-identification at Customs area.

USE CASE	DOG TRACK OR SIMULATED DOG DIGITALIZED SIGNAL WITHIN CHAIN OF OPERATIONS	TAG READER FOR EXTERNAL KNOWLEDGE OR SIMULATED EXTERNAL KNOWLEDGE WITHIN CHAIN OF OPERATIONS	CAMERA - RE-IDENTIFICATION SYSTEM	CT SCANNER OR VIRTUAL (SIMULATED) CT SCANNER WITHIN CHAIN OF OPERATIONS
UC1: BILLUND AIRPORT, DENMARK	SIMULATED	SIMULATED	YES	CT SCANNER (PHYSICALLY AT LOCATION)

Figure 8: BAG-INTEL customization for Use Case 1 at Billund Airport, Denmark

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Table 23: BAG-INTEL technologies to be used by Use-Case 1

A/A	BAG-INTEL Technology Name	Applied in Use Case 1 (Yes/No)
1.	Knowledge Management System (simulated)	Yes
2.	Digital Twin	N/A
3.	X-Ray analysis Algorithm	Yes
4.	AI Re-identification sub-system	Yes
5.	Global Risk Indicator Mathematical Model	Yes
6.	Knowledge Decision System	Yes
7.	User Interface. Real-Time Visualization for Decision Support – Decision to Inspect a Bag	Yes
8.	User Interface. Real-Time Visualization for Decision Support – Monitoring the entire flow of the bags	Yes
9.	User Interface. Real-Time Decision Support for Customs – Recognition of reidentified bags	Yes
10.	User Interface. Real-Time Decision Support for Customs – Feedback by Customs	Yes
11.	Machine Learning tools for Continuous improvement of decision making	Yes

Table 23 provides a list of the BAG-INTEL technologies used in Use Case 1.

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3.6.2 Description of Scenarios for Use Case 1

In this section description of the scenarios for Use Case 1 are presented in the form of tables providing information based on the attributes of the scenarios, structured based on the ISO/IEC/IEEE 29148:2011 international standard and guidelines from the industry.

Table 24: Scenario UC1_SCE_BLL_01

Section	Description
ID	**UC1_SCE_BLL_01**
Created By	**Billund Airport, DK: TOLD**
Title	**Detection of a medium quantity contraband "Narcotic X" based on risk indicator by the X-ray/CT scanner (I_x). Re-identification at Customs area.**
Description	A passenger flight lands in Billund Airport and is chosen for control of checked-in baggage through the BAG-INTEL system. The luggage includes contraband of category "Narcotic X". The demonstration will show that the X-ray/CT scanner can find the contraband of category "Narcotic X" and generate a high-level risk indicator (I_x), the cameras can re-identify the luggage, and the underlying system will inform the Custom Officers on site. The inspection results in the finding of contraband "Narcotic X" in the luggage and identification of the owner.
Primary Actor	Customs Officers
Channel to Primary Actor	Graphical User Interface: Real-Time Visualization for Decision Support
Secondary Actors	Police, System Administrators
Channel to Secondary Actors	Customs Officers protocol of operations
Objectives	**Objective 1:** The X-Ray sub-system automatically detects contraband of category "Narcotic X" in a bag and generates a high-level risk indicator (I_x). **Objective 2:** The re-identification system, effectively re-identifies the bag informing Customs Officers through the respective GUI. **Objective 3:** Customs Officers by using the BAG-INTEL system, are effectively supported in their decision making through the BAG-INTEL GUI, decide to inspect and find contraband of "narcotic X" in a bag.
Trigger - Contraband	Contraband of category "Narcotic X" is hidden in a piece of luggage.

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Trigger - X-Ray scanner AI analysis	Yes
Trigger - External Data Sources	No
Trigger – Dog Signal	No
Trigger – re-identification	N/A
Re-identification operations	Standard re-identification topology
Re-identification description	Standard suitcase
Airport State	Standard conditions
Flight characterization	No high-risk flight
Season	Standard conditions
Pre-conditions	BAG-INTEL Customization for Use Case 1 is in place (Fig. <fig:>). A passenger flight has been chosen for inspection. The checked-in luggage is handled to the belt linked to the BAG-INTEL system. Customs do not have any other indications of risk e.g., data from PNR or other sources.
Post-Conditions	The contraband and the owner are identified by the Custom Officers and handled over to the police. The BAG-INTEL system is trained based on the findings.
Security Requirements	Security plan is in place (Secret)
Safety Requirements	Safety plan is in place (Secret)
Scenario Normal Flow	**1.0 Detection of a medium quantity contraband "Narcotic X" based on risk indicator by the X-ray/CT scanner (I_x). Re-identification at Customs area.**

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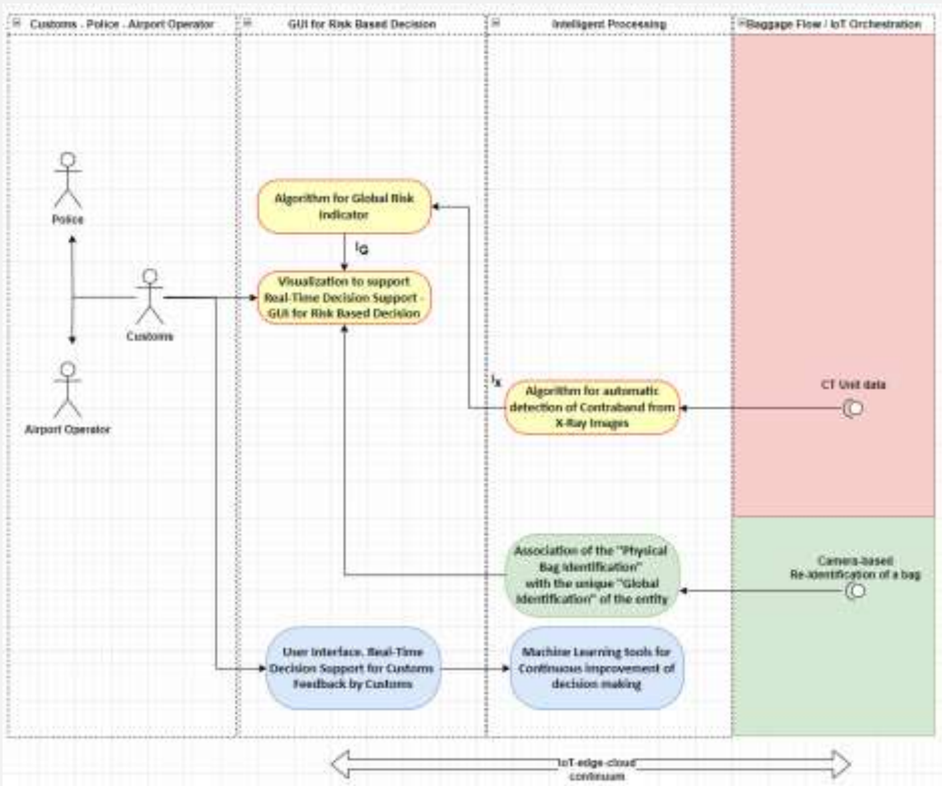
	1. Incoming Bag is placed on the luggage belt. 2. Bag is identified by re-identification cameras. 3. X-ray/CT scanner scans and analyzes Bag contents. 4. X-ray/CT scanner generates a high-level risk indicator (I_x). 5. The X-ray/CT scanner risk indicator I_x and the Global risk indicator (I_G) are shown on GUI at Customs. 6. Bag is re-identified at Customs area and shown on GUI. 7. Bag is inspected by Customs Officers. 8. Contraband and Owner are physically identified by the Customs Officers and handled to the Police. 9. System is trained based on the findings.
Scenario Alternative Flows	N/A
Scenario Exceptions	N/A
UML User Diagram	
Priority	High
Success Criteria	- X-ray/CT scanner to detect contraband of category “Narcotic X” and generates a high-risk indicator (I_x). - The Global Risk Indicator (I_G), effectively reflects the signal from the X-ray/CT scanner basic risk indicator (I_x). - GUI effectiveness to present the risk of contraband existence in the bag. - GUI effectiveness to present re-identification information

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	- Precision and correctness of information to support Customs decision making in order to apply the necessary Customs procedures.

Table 25: Scenario UC1_SCE_BLL_02

Section	Description
ID	**UC1_SCE_BLL_02**
Created By	**Billund Airport, DK: TOLD**
Title	**Detection of a very-small quantity of contraband "Narcotic X".** **Very-low risk indicator by the X-ray/CT scanner (I_x).** **Very-high risk indicator from External Data (I_i).** **Re-identification at Customs area.**
Description	A passenger flight lands in Billund Airport and is chosen for control of checked-in baggage through the BAG-INTEL system. The luggage includes a very-small quantity of contraband category "Narcotic X". The demonstration addresses the case where a contraband quantity is lower than the minimum identifiable quantity based on the specifications of the X-ray/CT scanner, thus the scanner cannot find the very-small quantity of category "Narcotic X", i.e. the X-ray/CT scanner generates a very-low risk indicator (I_x). Based on External Data analysis, a very-high risk indicator from External Data is generated (I_i). The cameras can re-identify the luggage, and the underlying system will inform the custom officers on site. The inspection results in the finding of the very-low quantity of contraband "Narcotic X" in the luggage and identification of the owner.
Primary Actor	Customs Officers
Channel to Primary Actor	Graphical User Interface: Real-Time Visualization for Decision Support
Secondary Actors	Police, System Administrators
Channel to Secondary Actors	Customs Officers protocol of operations
Objectives	**Objective 1:** In the case when the X-Ray sub-system cannot detect contraband of category "Narcotic X" in a bag due to a very-low quantity, the existence of a very-high risk indicator from External Data (I_i) can subsequently generate a very-high Global risk indicator (I_G). **Objective 2:** The re-identification system, effectively re-identifies the bag informing Customs Officers through the respective GUI.

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	Objective 3: Customs Officers by using the BAG-INTEL system, are effectively supported in their decision making through the BAG-INTEL GUI, decide to inspect and find contraband of “Narcotic X” in a bag.
Trigger - Contraband	A very-small quantity of Contraband of category “narcotic X” is hidden in a piece of luggage.
Trigger - X-Ray scanner AI analysis	Yes
Trigger - External Data Sources	Yes (simulated)
Trigger – Dog Signal	No
Trigger – re-identification	N/A
Re-identification operations	Standard re-identification topology
Re-identification description	Standard suitcase
Airport State	Standard conditions
Flight Characterization	No high-risk flight
Season	Standard conditions
Pre-conditions	BAG-INTEL Customization for Use Case 1 is in place (Fig. <fig:>). A passenger flight has been chosen for inspection. The checked-in luggage is handled to the belt linked to the BAG-INTEL system. Information from External Data generates a very-high risk indicator from External Data (I_i).
Post-Conditions	The contraband and the owner are identified by the custom officers and handled over to the police. The BAG-INTEL system is trained based on the findings.
Security Requirements	Security plan is in place (Secret)

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Safety Requirements	Safety plan is in place (Secret)
Scenario Normal Flow	**2.0 Detection of a very-small quantity of contraband "Narcotic X". Very-low risk indicator by the x-ray/CT scanner (I_x). Very-high risk indicator from External Data (I_i). Re-identification at Customs area.** 1. External Data analysis generates a very-high risk indicator from External Data (I_i) ; subsequent generation of a very-high Global risk indicator (I_G). 2. Incoming Bag is placed on the luggage belt. **3.** The Global Risk Indicator (I_G), effectively reflects the signal from the External Data basic risk indicator (I_i). 4. The External Data risk indicator (I_i) and the Global risk indicator (I_G) are shown on GUI at Customs. 5. Bag is identified by re-identification cameras. 6. X-ray/CT scanner scans and analyzes Bag contents. 7. X-ray/CT scanner generates a very-low risk indicator (I_x) (due to the fact that the quantity is lower than the minimum identifiable quantity based on the specifications of the X-ray/CT scanner). 8. Bag is re-identified at Customs area and shown on GUI. 9. Bag is inspected by Customs Officers. 10. Contraband and Owner are physically identified by the Customs Officers and handled to the Police. 11. System is trained based on the findings.
Scenario Alternative Flows	N/A
Scenario Exceptions	N/A

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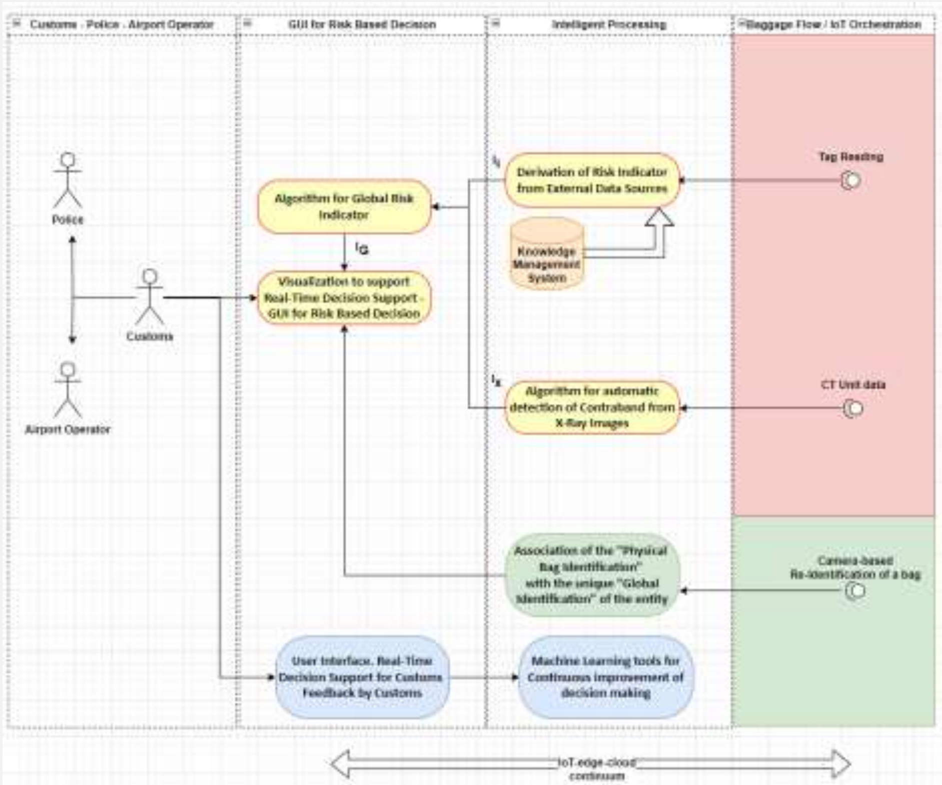
UML User Diagram	
Priority	High
Success Criteria	- External Data analysis generates a very-high risk indicator from External Data (I_i) ; subsequent generation of a very-high Global risk indicator (I_G) for the case when X-ray/CT scanner generates a very-low risk indicator (I_X). - GUI effectiveness to present the risk of contraband existence in the bag. - GUI effectiveness to present re-identification information. - Precision and correctness of information to support Customs decision making in order to apply the necessary Customs procedures.

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3.7 USE CASE 2 (MEDIUM INTERNATIONAL AIRPORT): THESSALONIKI AIRPORT 'MAKEDONIA', GREECE

3.7.1 Goals and Objectives

The Use Case 2 at Thessaloniki Airport 'Makedonia', Greece, is the Medium International Airport to test and demonstrate the capabilities of the BAG-INTEL system.

Use Case 2 will focus on the different levels of ability of the BAG-INTEL system for automatic detection of the narcotic "brown heroin" mentioned throughout this document as Contraband Y.

Due to the large shipping and operational costs and the time constraints for shipping the X-ray/CT scanner to all three airports, Use Case 2 at Thessaloniki Airport "Makedonia", will receive digital information from scans of "brown heroin" from the X-ray/CT scanner located in Billund Airport in Denmark. This information will be used by the integrating software modules of the BAG-INTEL system located at the Use Case 2 pilot at Thessaloniki Airport 'Makedonia', in order to simulate the risk indicator generated by the X-ray/CT scanner (I_x) for "brown heroin" in a transparent way, thus testing the rest of the BAG-INTEL sub-systems and the overall operational effectiveness, during the end-to-end demonstration.

Figure 9 presents the customization of the BAG-INTEL system for the needs of Thessaloniki Airport 'Makedonia'.

As shown in the figure and explained in the previous paragraphs, the X-ray/CT scanner will be simulated at the airport. The Dog Track will also be simulated. The Re-Identification system will be implemented physically at the Thessaloniki Airport 'Makedonia' and the physical existence of a Tag Reader will enable usage of External Knowledge. Simulated signals and information will be supported by the integration software components of the BAG-INTEL system.

USE CASE	DOG TRACK OR SIMULATED DOG DIGITALIZED SIGNAL WITHIN CHAIN OF OPERATIONS	TAG READER FOR EXTERNAL KNOWLEDGE OR SIMULATED EXTERNAL KNOWLEDGE WITHIN CHAIN OF OPERATIONS	CAMERA - RE-IDENTIFICATION SYSTEM	CT SCANNER OR VIRTUAL (SIMULATED) CT SCANNER WITHIN CHAIN OF OPERATIONS
UC2: THESSALONIKI AIRPORT MAKEDONIA, GREECE	SIMULATED	YES	YES	VIRTUAL (SIMULATED) CT SCANNER

Figure 9: BAG-INTEL customization for Use Case 2 at Thessaloniki Airport "Makedonia", Greece

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The first scenario developed by the Use Case 2 partners, scenario UC2_SCE_MAK_01 presented in section 3.7.2, has as main objective the detection of 3 bags of contraband "Narcotic Y" concealed in a metallic box between a laptop and a tabled based on a risk indicator generated by the (sniffer) dog handler (I_d) and a risk indicator generated by the X-ray/CT scanner (I_x). It will also test the efficiency of the Re-identification at Customs area.

The second scenario developed by the Use Case 2 partners, scenario UC2_SCE_MAK_02 presented in section 3.7.2, has as main objective the detection of 5 bags of contraband "Narcotic Y" concealed in a metallic box based on intelligence information and analysis of External Data, generating a risk indicator (I_i) and based on the risk indicator from the X-ray/CT scanner (I_x). The scenario will also test the efficiency of the Re-identification at Customs area.

Table 26 provides a list of the BAG-INTEL technologies used in Use Case 2.

Table 26: BAG-INTEL technologies to be used by Use-Case 2

A/A	BAG-INTEL Technology Name	Applied in Use Case 1 (Yes/No)
1.	Knowledge Management System	Yes
2.	Digital Twin (to be included in the second/final version of this document)	Yes
3.	X-Ray analysis Algorithm (simulated)	Yes
4.	AI Re-identification sub-system	Yes
5.	Global Risk Indicator Mathematical Model	Yes
6.	Knowledge Decision System	Yes
7.	User Interface. Real-Time Visualization for Decision Support – Decision to Inspect a Bag	Yes
8.	User Interface. Real-Time Visualization for Decision Support – Monitoring the entire flow of the bags	Yes
9.	User Interface. Real-Time Decision Support for Customs – Recognition of reidentified bags	Yes
10.	User Interface. Real-Time Decision Support for Customs – Feedback by Customs	Yes
11.	Machine Learning tools for Continuous improvement of decision making	Yes

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3.7.2 Description of Scenarios for Use Case 2

In this section description of the scenarios for Use Case 1 are presented in the form of tables providing information based on the attributes of the scenarios, structured based on the ISO/IEC/IEEE 29148:2011 international standard and guidelines from the industry.

Table 27: Scenario UC2_SCE_MAK_01

Section	Description
ID	**UC2_SCE_MAK_01**
Created By	**Thessaloniki Airport "Makedonia", GR: IAPR**
Title	**Detection of 3 bags of contraband "Narcotic Y" concealed in a metallic box between a laptop and a tabled based on: risk indicator from (sniffer) dog handler (I_d), and risk indicator from the X-ray/CT scanner (I_x). Re-identification at Customs area.**
Description	A passenger high-risk flight lands in Thessaloniki Airport "Makedonia", and is chosen for control of checked-in baggage through the BAG-INTEL system. A luggage includes contraband of category "Narcotic Y". The demonstration will show that generated risk indicator from the (sniffer) dog handler (I_d) will be very high and the X-ray/CT scanner can detect the contraband of category "Narcotic Y" and generate a high-level risk indicator (I_x). The cameras can re-identify the luggage, and the underlying system will inform the custom officers on site. The inspection results in the finding of contraband "Narcotic Y" in the luggage and identification of the passenger.
Primary Actor	Customs Officers
Channel to Primary Actor	Graphical User Interface: Real-Time Visualization for Decision Support
Secondary Actors	Police, System Administrators
Channel to Secondary Actors	Customs Officers protocol of operations
Objectives	**Objective 1:** Two basic risk indicators generate a very-high risk Global Indicator (I_G) for "Narcotic Y", from 3 plastic bags, concealed within the luggage in specific arrangement between a tablet and a laptop (the luggage includes additional bags with oregano and mint): The (sniffer) dog recognizes the contraband and its handler signals a very-high risk indicator (I_d) and the X-ray/CT scanner detects the contraband of category "Narcotic Y" and generates a very-high risk indicator (I_x). **Objective 2:** The re-identification system, effectively re-identifies the bag informing Customs Officers through the respective GUI.

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	Objective 3: Customs Officers by using the BAG-INTEL system, are effectively supported in their decision making through the BAG-INTEL GUI, decide to inspect and find contraband of "Narcotic Y" in a bag.
Trigger - Contraband	Contraband of category "Narcotic Y" is hidden in a piece of luggage.
Trigger - X-Ray scanner AI analysis	Yes (simulated)
Trigger - External Data Sources	No
Trigger – Dog Signal	Yes (simulated)
Trigger – re-identification	N/A
Re-identification operations	Standard re-identification topology
Re-identification description	Standard suitcase
Airport State	Standard conditions
Flight characterization	High-risk flight
Season	Standard conditions
Pre-conditions	BAG-INTEL Customization for Use Case 2 is in place (Fig. <fig:>). A passenger high-risk flight has been chosen for inspection. A high-risk flight has been chosen for inspection. The checked-in luggage is handled to the belt that contains the Bag-Intel equipment. Customs do not have any other indications of risk from external data sources.
Post-Conditions	The contraband and the owner are found by the custom police officers and arrested.
Security Requirements	Security plan is in place (Secret)

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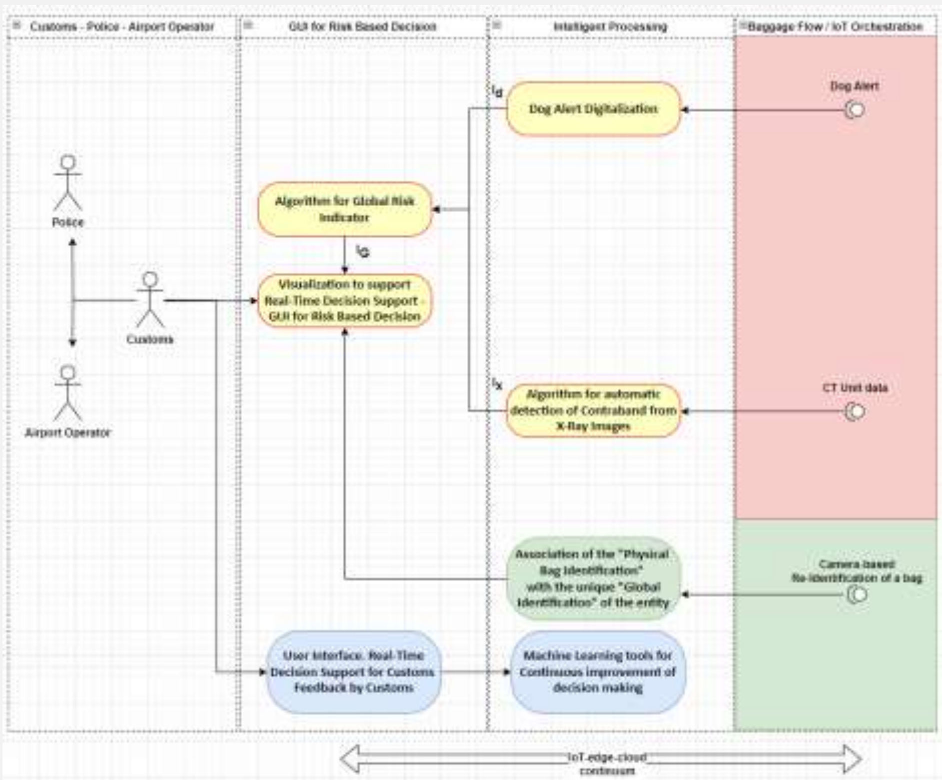
<table>
<tr><td>Safety Requirements</td><td>Safety plan is in place (Secret)</td></tr>
<tr><td>Scenario Normal Flow:</td><td>1.0 Detection of 3 bags of contraband “Narcotic Y” concealed in a metallic box between a laptop and a tabled based on: risk indicator from (sniffer) dog handler (I_d), and risk indicator from the X-ray/CT scanner (I_x). Re-identification at Customs area.

1. An incoming Bag is placed on the luggage belt.
2. The (sniffer) dog recognizes the contraband and its handler signals a very-high risk indicator (I_d) .
3. The Bag is identified by re-identification cameras.
4. X-ray/CT scanner scans and analyzes Bag contents.
5. X-ray/CT scanner generates a high-level risk indicator (I_x).
6. The dog handler risk indicator (I_d), the X-ray/CT scanner risk indicator (I_x) and the Global risk indicator (I_G) are shown on GUI at Customs.
7. Bag is re-identified at Customs area and shown on GUI.
8. Bag is inspected by Customs Officers.
9. Contraband and Owner are physically identified by the Customs Officers and handled to the Police.
10. System is trained based on the findings.</td></tr>
<tr><td>Scenario Alternative Flows</td><td>N/A</td></tr>
<tr><td>Scenario Exceptions</td><td>N/A</td></tr>
<tr><td>UML User Diagram</td><td>
</td></tr>
</table>

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Priority	High
Success Criteria	- The (sniffer) dog recognizes the contraband of category "Narcotic Y" and its handler signals a very-high risk indicator (I_d). - X-ray/CT scanner detects contraband of category "Narcotic Z" and generates a high-risk indicator (I_x). - The Global Risk Indicator (I_G), effectively reflects the signals from the basic risk indicators (I_d) and (I_x). - GUI effectiveness to present the risk of contraband existence in the bag. - GUI effectiveness to present re-identification information - Precision and correctness of information to support Customs decision making in order to apply the necessary Customs procedures.

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Table 28: Scenario UC2_SCE_MAK_O2

Section	Description
ID	**UC2_SCE_MAK_02**
Created By	**Thessaloniki Airport "Makedonia", GR: IAPR**
Title	**Detection of 5 bags of contraband "Narcotic Y" concealed in a metallic box based on intelligence information and analysis of External Data risk indicator (I_i) and risk indicator from the X-ray/CT scanner (I_x). Re-identification at Customs area.**
Description	An e-mail is sent from the intelligence to the Greek Customs, regarding the arrival of a suspect that carries narcotics in his luggage. The said passenger started his trip from country A to Thessaloniki via country B carrying one red suitcase. The Customs track the passenger and the flight and inform both the Police and the airport security. The passenger high-risk flight lands in Thessaloniki Airport "Makedonia", and is chosen for control of checked-in baggage through the BAG-INTEL system. A luggage includes contraband of category "Narcotic Y". The demonstration will show that the risk indicator from External Data (I_i) will be very high and the X-ray/CT scanner can detect the contraband of category "Narcotic Y" and generate a high-level risk indicator (I_x). The cameras can re-identify the luggage, and the underlying system will inform the custom officers on site. The inspection results in the finding of contraband "Narcotic Y" in the luggage and identification of the passenger.
Primary Actor	Customs Officers
Channel to Primary Actor	Graphical User Interface: Real-Time Visualization for Decision Support
Secondary Actors	Police, System Administrators
Channel to Secondary Actors	Customs Officers protocol of operations
Objectives	**Objective 1:** Two basic risk indicators generate a very-high risk Global Indicator (I_G) for "Narcotic Y", from 5 plastic bags, concealed within the luggage in a metallic box. The External Data analysis signals a very-high risk indicator (I_i) and the X-ray/CT scanner detects the contraband of category "Narcotic Y" and generates a very-high risk indicator (I_x). **Objective 2:** The re-identification system, effectively re-identifies the bag informing Customs Officers through the respective GUI. **Objective 3:** Customs Officers by using the BAG-INTEL system, are effectively supported in their decision making through the BAG-INTEL GUI, decide to inspect and find contraband of "Narcotic Y" in a bag.

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Trigger - Contraband	Contraband of category “Narcotic Y” in 5 plastic bags. The plastic bags are in a metallic box.
Trigger - X-Ray scanner AI analysis	Yes (simulated)
Trigger - External Data Sources	Yes (simulated)
Trigger – Dog Signal	No
Trigger – re-identification	N/A
Re-identification operations	Standard re-identification topology
Re-identification description	Standard suitcase
Airport State	Standard conditions
Flight characterization	High-risk flight
Season	Standard conditions
Pre-conditions	BAG-INTEL Customization for Use Case 2 is in place (Fig. <fig:>). A passenger high-risk flight has been chosen for inspection. A high-risk passenger flight has been chosen for inspection after intelligence information received by the customs. The checked-in luggage will be handled at the belt that contains the BAG-INTEL equipment.
Post-Conditions	The contraband and the owner are found by the custom police officers and arrested.
Security Requirements	Security plan is in place (Secret)
Safety Requirements	Safety plan is in place (Secret)

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Scenario Normal Flow	**2.0 Detection of 5 bags of contraband "Narcotic Y" concealed in a metallic box based on intelligence information and analysis of External Data risk indicator (I_i) and risk indicator from the X-ray/CT scanner (I_x). Re-identification at Customs area.** 1. Intelligence information and External Data analysis generates a very-high risk indicator from External Data (I_i) ; subsequent generation of a very-high Global risk indicator (I_G). 2. Incoming Bag is placed on the luggage belt. 3. The External Data risk indicator (I_i) and the Global risk indicator (I_G) are shown on GUI at Customs. 4. The Bag is identified by re-identification cameras. 5. X-ray/CT scanner scans and analyzes Bag contents. 6. X-ray/CT scanner generates a high-level risk indicator (I_x). 7. The External Data basic risk indicator (I_i), the X-ray/CT scanner basic risk indicator I_x and the Global risk indicator (I_G) are shown on GUI at Customs. 8. Bag is re-identified at Customs area and shown on GUI. 9. Bag is inspected by Customs Officers. 10. Contraband and Owner are physically identified by the Customs Officers and handled to the Police. 11. System is trained based on the findings.
Scenario Alternative Flows	N/A
Scenario Exceptions	N/A

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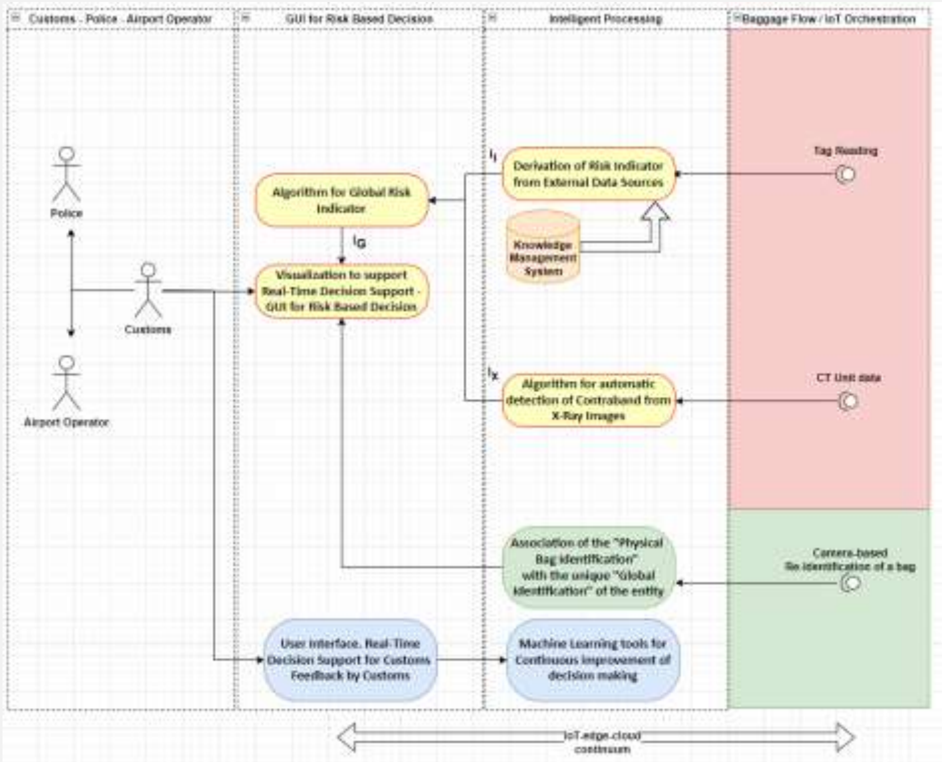
<table>
<tr><td>UML
User Diagram</td><td>


</td></tr>
<tr><td>Priority</td><td>High</td></tr>
<tr><td>Success Criteria</td><td>
- External Data analysis, processes intelligence information and generates a high-risk indicator from External Data (I_i).
- X-ray/CT scanner detects contraband of category “Narcotic Y” and generates a high-risk indicator (I_x).
- The Global Risk Indicator (I_G), effectively reflects the signals from the basic risk indicators (I_i) and (I_x).
- GUI effectiveness to present the risk of contraband existence in the bag.
- GUI effectiveness to present re-identification information
- Precision and correctness of information to support Customs decision making in order to apply the necessary Customs procedures.
</td></tr>
</table>

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3.8 USE CASE 3 (LARGE INTERNATIONAL AIRPORT): ADOLFO SUÁREZ MADRID–BARAJAS AIRPORT, SPAIN

3.8.1 Goals and Objectives

The Use Case 3 at Adolfo Suárez Madrid–Barajas Airport, Spain, is the Large International Airport to test and demonstrate the capabilities of the BAG-INTEL system.

Use Case 3 will focus on the different levels of ability of the BAG-INTEL system for automatic detection of the narcotic "Cocain" mentioned throughout this document as Contraband Z.

Due to the large shipping and operational costs and the time constraints for shipping the X-ray/CT scanner to all three airports, Use Case 3 at Adolfo Suárez Madrid–Barajas Airport will receive digital information from scans of "Cocain" from the X-ray/CT scanner located in Billund Airport in Denmark. This information will be used by the integrating software modules of the BAG-INTEL system located at the Use Case 3 pilot at Adolfo Suárez Madrid–Barajas Airport, in order to simulate the risk indicator generated by the X-ray/CT scanner (I_x) for "Cocain" in a transparent way, thus testing the rest of the BAG-INTEL sub-systems and the overall operational effectiveness, during the end-to-end demonstration.

Figure 10 presents the customization of the BAG-INTEL system for the needs of Adolfo Suárez Madrid–Barajas Airport.

As shown in the figure and explained in the previous paragraphs, the X-ray/CT scanner will be simulated at the airport. The Dog Track will also be simulated. The Re-Identification system will be implemented physically at the Adolfo Suárez Madrid–Barajas Airport and the physical existence of a Tag Reader will enable usage of External Knowledge. Simulated signals and information will be supported by the integration software components of the BAG-INTEL system.

USE CASE	DOG TRACK OR SIMULATED DOG DIGITALIZED SIGNAL WITHIN CHAIN OF OPERATIONS	TAG READER FOR EXTERNAL KNOWLEDGE OR SIMULATED EXTERNAL KNOWLEDGE WITHIN CHAIN OF OPERATIONS	CAMERA - RE-IDENTIFICATION SYSTEM	CT SCANNER OR VIRTUAL (SIMULATED) CT SCANNER WITHIN CHAIN OF OPERATIONS
UC3:ADOLFO SUÁREZ MADRID–BARAJAS AIRPORT, SPAIN	SIMULATED	YES	YES	VIRTUAL (SIMULATED) CT SCANNER

Figure 10: BAG-INTEL customization for Use Case 3 at Adolfo Suárez Madrid–Barajas Airport

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The first scenario developed by the Use Case 3 partners, scenario UC3_SCE_MAD_01 presented in section 3.8.2, has as main objective the detection of a medium quantity contraband “Narcotic Z” based on risk indicator by the X-ray/CT scanner (I_x). It will also test the efficiency of the Re-identification at Customs area.

The second scenario developed by the Use Case 3 partners, scenario UC3_SCE_MAK_03 presented in section 3.8.2, has as main objective to use a strong set of 3 risk indicators in order to detect a medium quantity of contraband “Narcotic Z”. These risk indicators are: the risk indicator from (sniffer) dog handler (I_d), the risk indicator from External Data (I_i) and the risk indicator from the X-ray/CT scanner (I_x). The scenario will also test the efficiency of the Re-identification at Customs area.

Table 29 provides a list of the BAG-INTEL technologies used in Use Case 3.

Table 29: BAG-INTEL technologies to be used by Use-Case 3

A/A	BAG-INTEL Technology Name	Applied in Use Case 1 (Yes/No)
1.	Knowledge Management System	Yes
2.	Digital Twin (to be included in the second/final version of this document)	N/A
3.	X-Ray analysis Algorithm (simulated)	Yes
4.	AI Re-identification sub-system	Yes
5.	Global Risk Indicator Mathematical Model	Yes
6.	Knowledge Decision System	Yes
7.	User Interface. Real-Time Visualization for Decision Support – Decision to Inspect a Bag	Yes
8.	User Interface. Real-Time Visualization for Decision Support – Monitoring the entire flow of the bags	Yes
9.	User Interface. Real-Time Decision Support for Customs – Recognition of reidentified bags	Yes
10.	User Interface. Real-Time Decision Support for Customs – Feedback by Customs	Yes
11.	Machine Learning tools for Continuous improvement of decision making	Yes

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3.8.2 Description of Scenarios for Use Case 3

In this section description of the scenarios for Use Case 3 are presented in the form of tables providing information based on the attributes of the scenarios, structured based on the ISO/IEC/IEEE 29148:2011 international standard and guidelines from the industry.

Table 30: Scenario UC3_SCE_MAD_01

Section	Description
ID	**UC3_SCE_MAD_01**
Created By	**Adolfo Suárez Madrid–Barajas Airport, ES: GUCI**
Title	**Detection of a medium quantity of contraband "Narcotic Z" based on risk indicator by the x-ray/CT scanner (I_x). Re-identification at Customs area.**
Description	A high-risk passenger flight lands in Adolfo Suárez Madrid–Barajas Airport and is chosen for control of checked-in baggage through the BAG-INTEL system. A luggage includes contraband of category "Narcotic Z". The demonstration will show that the X-ray/CT scanner can find the contraband of category "Narcotic Z" and generate a high-level risk indicator (I_x), the cameras can re-identify the luggage, and the underlying system will inform the custom officers on site. The inspection results in the finding of contraband "Narcotic Z" in the luggage and identification of the passenger.
Primary Actor	Customs Officers
Channel to Primary Actor	Graphical User Interface: Real-Time Visualization for Decision Support
Secondary Actors	Police, System Administrators
Channel to Secondary Actors	Customs Officers protocol of operations
Objectives	**Objective 1:** The X-Ray sub-system automatically detects contraband of category "narcotic Z" in a bag and generates a high-level risk indicator (I_x). **Objective 2:** The re-identification system, effectively re-identifies the bag informing Customs Officers through the respective GUI. **Objective 3:** Customs Officers by using the BAG-INTEL system, are effectively supported in their decision making through the BAG-INTEL GUI, decide to inspect and find contraband of "Narcotic Z" in a bag.
Trigger - Contraband	Contraband of category "Narcotic Z" is hidden in a piece of luggage.

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Trigger - X-Ray scanner AI analysis	Yes (simulated)
Trigger - External Data Sources	No
Trigger – Dog Signal	No
Trigger – re-identification	N/A
Re-identification operations	Standard re-identification topology
Re-identification description	Standard suitcase
Airport State	Standard conditions
Flight characterization	High-risk flight
Season	Standard conditions
Pre-conditions	BAG-INTEL Customization for Use Case 3 is in place (Fig. <fig:>). A passenger high-risk flight has been chosen for inspection. A high risk flight has been chosen for inspection. The checked-in luggage is handled to the belt that contains the Bag-Intel equipment. Customs do not have any other indications of risk from external data sources.
Post-Conditions	The contraband and the owner are found by the custom police officers and arrested.
Security Requirements	Security plan is in place (Secret)
Safety Requirements	Safety plan is in place (Secret)
Scenario Normal Flow	**1.0 Detection of a medium quantity of contraband "Narcotic Z" based on risk indicator by the X-ray/CT scanner (I_x). Re-identification at Customs area.** 1. An incoming Bag is placed on the luggage belt.

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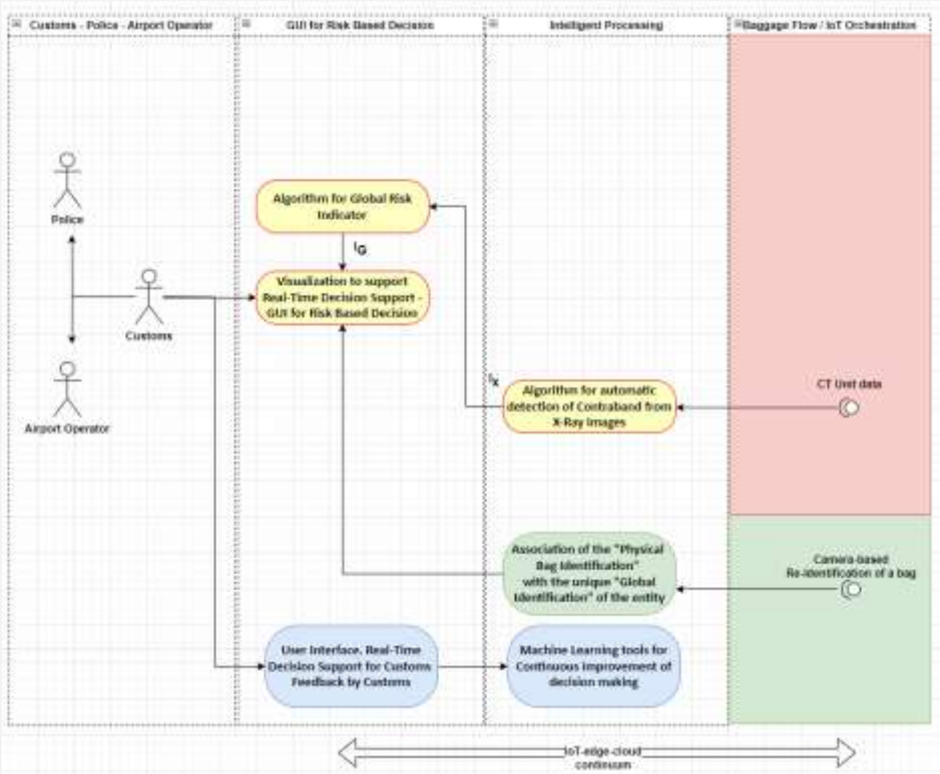
	2. The bag is identified by re-identification cameras. 3. X-ray/CT scanner scans and analyzes bag contents. 4. X-ray/CT scanner generates a high-level risk indicator (I_x). 5. The X-ray/CT scanner risk indicator I_x and the Global risk indicator (I_G) are shown on GUI at Customs. 6. Bag is re-identified at Customs area and shown on GUI. 7. Bag is inspected by Customs Officers. 8. Contraband and Owner are physically identified by the Customs Officers and handled to the Police. 9. System is trained based on the findings.
Scenario Alternative Flows	N/A
Scenario Exceptions	N/A
UML User Diagram	
Priority	High
Success Criteria	- X-ray/CT scanner detects contraband of category "Narcotic Z" and generates a high-risk indicator (I_x). - The Global Risk Indicator (I_G), effectively reflects the signal from the basic risk indicator (I_x). - GUI effectiveness to present the risk of contraband existence in the bag. - GUI effectiveness to present re-identification information - Precision and correctness of information to support Customs decision making in order to apply the necessary Customs procedures.

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Table 31: Scenario UC3_SCE_MAD_02

Section	Description
ID	**UC3_SCE_MAD_02**
Created By	**Adolfo Suárez Madrid–Barajas Airport, ES: GUCI**
Title	**Detection of a medium quantity of contraband "Narcotic Z" based on:** **risk indicator from (sniffer) dog handler (I_d),** **risk indicator from External Data (I_i) and** **risk indicator from the X-ray/CT scanner (I_x).** **Re-identification at Customs area.**
Description	A no high-risk passenger flight lands in Adolfo Suárez Madrid–Barajas Airport and is chosen for control of checked-in baggage through the BAG-INTEL system. A luggage includes contraband of category "Narcotic Z". The demonstration will show that analysis of External Data will signal a very-high risk indicator from External Data (I_i), the risk indicator from the (sniffer) dog handler (I_d) will also be very high and the X-ray/CT scanner can detect the contraband of category "Narcotic Z" and generate a high-level risk indicator (I_x). The cameras can re-identify the luggage, and the underlying system will inform the custom officers on site. The inspection results in the finding of contraband "Narcotic Z" in the luggage and identification of the passenger.
Primary Actor	Customs Officers
Channel to Primary Actor	Graphical User Interface: Real-Time Visualization for Decision Support
Secondary Actors	Police, System Administrators
Channel to Secondary Actors	Customs Officers protocol of operations
Objectives	**Objective 1:** Three basic risk indicators generate a very-high risk Global Indicator (I_G) for "Narcotic Z": The External Data analysis generates a very-high risk indicator (I_i), the (sniffer) dog recognizes the contraband and its handler signals a very-high risk indicator (I_d) and the X-ray/CT scanner detects the contraband of category "Narcotic Z" and generates a very-high risk indicator (I_x). **Objective 2:** The re-identification system, effectively re-identifies the bag informing Customs Officers through the respective GUI. **Objective 3:** Customs Officers by using the BAG-INTEL system, are effectively supported in their decision making through the BAG-INTEL GUI, decide to inspect and find contraband of "Narcotic Z" in a bag.
Trigger - Contraband	Contraband of category "Narcotic Z" is hidden in a piece of luggage.

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Trigger - X-Ray scanner AI analysis	Yes (simulated)
Trigger - External Data Sources	Yes (simulated)
Trigger – Dog Signal	Yes (simulated)
Trigger – re-identification	N/A
Re-identification operations	Standard re-identification topology
Re-identification description	Standard suitcase
Airport State	Standard conditions
Flight characterization	No high-risk flight
Season	Standard conditions
Pre-conditions	BAG-INTEL Customization for Use Case 3 is in place (Fig. <fig:>). A no high-risk flight has been chosen for inspection. The checked-in luggage is handled to the belt that contains the Bag-Intel equipment.
Post-Conditions	The contraband and the owner are found by the custom police officers and arrested.
Security Requirements	Security plan is in place (Secret)
Safety Requirements	Safety plan is in place (Secret)
Scenario Normal Flow	**2.0 Detection of a medium quantity of contraband "Narcotic Z" based on: risk indicator from (sniffer) dog handler (I_d), risk indicator from External Data (I_i) and risk indicator from the X-ray/CT scanner (I_x). Re-identification at Customs area.**

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	1. Intelligence information and External Data analysis generates a very-high risk indicator from External Data (I_i) ; subsequent generation of a very-high Global risk indicator (I_G). 2. Incoming Bag is placed on the luggage belt. 3. The External Data risk indicator (I_i) and the Global risk indicator (I_G) are shown on GUI at Customs. 4. The Bag is identified by re-identification cameras. 5. X-ray/CT scanner scans and analyzes Bag contents. 6. X-ray/CT scanner generates a high-level risk indicator (I_x). 7. The External Data basic risk indicator (I_i), the X-ray/CT scanner basic risk indicator I_x and the Global risk indicator (I_G) are shown on GUI at Customs. 8. The (sniffer) dog recognizes the contraband and its handler signals a very-high risk indicator (I_d) . 9. The External Data basic risk indicator (I_i), the X-ray/CT scanner basic risk indicator (I_x), the dog handler basic risk indicator (I_d) and the Global risk indicator (I_G) are shown on GUI at Customs. 10. Bag is re-identified at Customs area and shown on GUI. 11. Bag is inspected by Customs Officers. 12. Contraband and Owner are physically identified by the Customs Officers and handled to the Police. 13. System is trained based on the findings.
Scenario Alternative Flows	N/A
Scenario Exceptions	N/A

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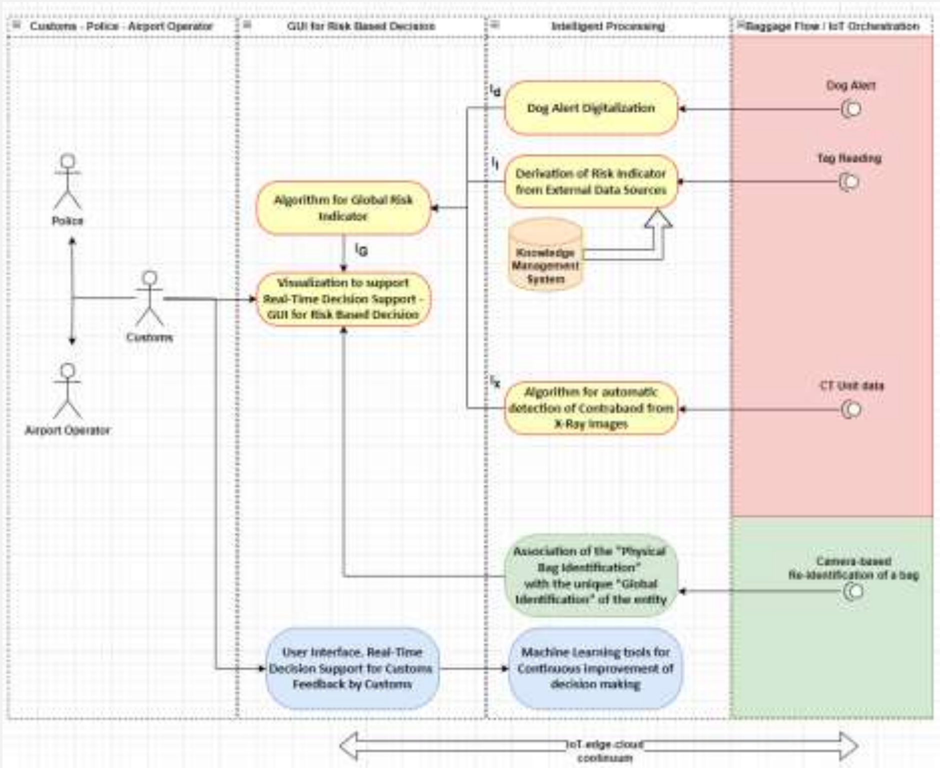
UML User Diagram	
Priority	High
Success Criteria	- External Data analysis, processes intelligence information and generates a high-risk indicator from External Data (I_i). - X-ray/CT scanner detects contraband of category “Narcotic Z” and generates a high-risk indicator (I_x). - The (sniffer) dog recognizes the contraband of category “Narcotic Y” and its handler signals a very-high risk indicator (I_d). - The Global Risk Indicator (I_G), effectively reflects the signals from the basic risk indicators (I_i), (I_x), and (I_d). - GUI effectiveness to present the risk of contraband existence in the bag. - GUI effectiveness to present re-identification information - Precision and correctness of information to support Customs decision making in order to apply the necessary Customs procedures.

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4 REQUIREMENTS TRACEABILITY MATRIX

In this section we present the Requirements Traceability Matrix (RTM Figure 11) of BAG-INTEL. The RTM links the Stakeholder Requirements presented in this document to their origin, and to the respective Use Case scenario to be tested/demonstrated, and traces these requirements throughout the project life cycle.

Figure 11: The Requirements Traceability Matrix of BAG-INTEL

Stakeholder Requirements		Use Case Scenarios					
		Use Case 1 (small international airport): Billund Airport, Denmark		Use Case 2 (medium international airport): Thessaloniki Airport 'Makedonia', Greece		Use case 3 (large international airport): Adolfo Suárez Madrid–Barajas Airport, Spain	
Stakeholder Requirement ID	Stakeholder Requirement Description	UC1_SCE_BLL_01	UC1_SCE_BLL_02	UC1_SCE_MAK_01	UC1_SCE_MAK_02	UC1_SCE_MAD_01	UC1_SCE_MAD_02
REQ_STK_01.01	The development of a knowledge management system to support the end-user requirements of the project, providing knowledge from external databases while applying the privacy and security recommendations.		X		X		X
REQ_STK_02.01	Digital Twin						
REQ_STK_03.01	Image recording of contraband						
REQ_STK_04.01	Development of an algorithm for automatic detection of contraband in bags by using the X-Ray images of REQ_STK_03.01. Generation of the Risk indicator by the X-ray/CT scanner (I_x).	X	X	X	X	X	X
REQ_STK_05.01	Camera-based signature extraction from a bag.	X	X	X	X	X	X
REQ_STK_05.02	Camera-based re-identification of a bag.	X	X	X	X	X	X
REQ_STK_05.03	Association of the "Physical Bag Identification" with the unique "Global Identification" of the entity in the integrated system.	X	X	X	X	X	X
REQ_STK_05.04	Support to resolve extraordinary incidents that may take place at the airport.						
REQ_STK_06.01	Derivation of the Risk Indicator from External Data Sources (I_e).		X		X		X
REQ_STK_06.02	Derivation of the Risk Indicator from Customs Officer (I_c).						
REQ_STK_06.03	Derivation of the Risk Indicator from (sniffer) dog handler (I_d).			X			X
REQ_STK_07.01	Definition of Contraband Presence Risk Indicators						
REQ_STK_07.02	Definition of the mathematical model and algorithm of the Global Risk Indicator	X	X	X	X	X	X
REQ_STK_07.03	Generation of a single Global Risk Indicator based on multiple Basic Risk Indicators.	X	X	X	X	X	X
REQ_STK_07.04	Improvement of the Risk Indication of the x-ray/CT scanner (I_x) by using the rest of the derived Basic Risk Indicators and Global Risk Indicator (I_G).		X	X	X		X
REQ_STK_08.01	User Interface for Risk Based Decision - Real-Time Decision Support for Customs	X	X	X	X	X	X
REQ_STK_08.02	Visualization, Monitoring the entire flow of bags - Real-Time Decision Support for Customs						
REQ_STK_08.03	GUI for Reidentification - Real-Time Decision Support for Customs	X	X	X	X	X	X
REQ_STK_08.04	GUI for Feedback - Real-Time Decision Support for Customs	X	X	X	X	X	X
REQ_STK_09.01	Customs Management: Decision support through simulation and visualization.						
REQ_STK_10.02	Continuous improvement of the decision making through Machine Learning	X	X	X	X	X	X

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5 CONCLUSIONS CHAPTER I

The End-User requirements specification of the BAG-INTEL system as part of the first version of the series of deliverables *"End users, legal and ethical requirements"* (D2.1) has been provided in this document.

By following a Stakeholder Requirements Definition Process, the Stakeholder Elicitation Activity has been followed. Within the activity:

1. Individual stakeholders and stakeholder classes have been identified, who have a legitimate interest in the system throughout its life cycle and

2. Stakeholder Requirements were elicited from the identified stakeholders and agreed.

Through the elicitation activity, the Stakeholder Requirements and the associated information for their attributes have been gathered and presented in the document. Six (6) scenarios for the three (3) Use Cases of BAG-INTEL have been developed by the primary stakeholders of the respective three (3) pilots, i.e. Billund Airport, Denmark (small international airport), Thessaloniki Airport 'Makedonia', Greece (medium international airport) and Adolfo Suárez Madrid–Barajas Airport, Spain (large international airport) and reported in this document.

The scenarios have been customized based on the characteristics and requirements of each airport. Due to the large shipping and operational costs and the time constraints for shipping the X-ray/CT scanner to all three airports, it was decided by the BAG-INTEL consortium that only the Billund Airport, Denmark will be hosting the X-ray/CT scanner physically, while the other two airports will be testing the BAG-INTEL system through simulated signals which will be generated by the X-ray/CT scanner for the different scenarios. This way the X-ray/CT scanner will be simulated for the two airports with the process being transparent for the rest of the sub-systems of BAG-INTEL during its end-to-end demonstration.

As next steps, we'll continue to maintain and update the StRS specification document based on the ongoing progress of the project. The second and final version of the StRS (Deliverable D2.2) will be submitted in M32 and will be including updates and new scenarios which will cover additional BAG-INTEL technologies and aspects of the system, including Digital Twins.

A requirements analysis process, a software requirements analysis process and architectural design process will follow based on this first version of End-User Requirements resulting in the system requirements specification (SyRS), Software requirements specification (SRS) and the Architecture of the system, which will be included in Deliverable D2.3 (M12).

The End-User Requirements will guide the Demonstration, Testing and Evaluation Planning task of BAG-INTEL (Task 5.1) as also the task for Demonstration, Testing and Evaluation Execution (Task 5.2).

Finally results from the Evaluation Feedback and Analysis of the Testing and Demonstration (Task 5.3) will be analyzed in order to optimise the final version of the End-User Requirements documentation (Deliverable D2.2 M32).

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Chapter II – Legal and Ethical Requirements

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EXECUTIVE SUMMARY CHAPTER II – LEGAL AND ETHICAL REQUIREMENTS

One of the main objectives of Task 2.1 is to develop an ethical and legal use of the technology used by BAG-INTEL. The project develops different digital technologies, including several with the use of artificial intelligence, which may have several risks when used within a security context.

The methodology adopted by BAG-INTEL is legal and ethical compliance by design, from the early stages of the project. To this end, three questionnaires have been designed on the risks of their use and their impact on fundamental rights, the use of data and the ethical use of intelligent systems.

Two are the main objectives of this task: 1) that the project partners keep in mind the legal and ethical issues that arise in a development in this context and for the technologies applied and 2) that the design of the systems is made in accordance with the respect of the fundamental rights of citizens and the respect of the ethical principles imposed by the European Commission.

To this end, three questionnaires were created and answered by the project's technology partners: 1) fundamental rights impact assessment, 2) data protection assessment and 3) ethical use of artificial intelligence.

The results of the questionnaires were used to make a series of recommendations tailored to the needs of each partner, which are included at the end of this deliverable.

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ABBREVIATIONS

AI	Artificial intelligence
DPIA	Data protection impact assessment
DPO	Data Protection Officer
EDPB	European Data Protection Board
ELSIA	Ethical legal and societal impact assessment
LEA	Legal enforcement agency
PNR	Passenger Name Record
SIS	Schengen Information System

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6 CHAPTER II. INTRODUCTION

6.1 BACKGROUND

The BAG-INTEL project addresses the problem of luggage control at airports to prevent smuggling by creating an intelligent scanner and baggage tracking system from baggage collection to airport customs control. The scanner will detect substances considered as contraband by means of an image recognition system that will detect possible contraband objects. Once the object is detected in the baggage, it can be monitored for tracking by customs authorities to the checkpoint.

The document was originally marked PU. However, it is recommended that the document remains confidential because it is intended to assist the consortium partners in the development and delivery of the BAG-INTEL tools and as such, it contains extensive references to the technology design and development raising security risks for LEAs.

6.2 PURPOSE AND SCOPE

This deliverable focuses on assessment of the impacts on ethics, data protection and other fundamental rights and the use of AI of the BAG-INTEL project. It sets a comprehensive report on activities that the consortium partners will conduct as part of task T2.2 and its findings. Considering the legal, ethical and societal requirements and constraints for intelligence-led technologies, the partners answered an ethical privacy assessment, ethical, legal and social impact assessment and a Trustworthy AI analysis of BAG-INTEL technologies.

In line with the BAG-INTEL Description of Action (DoA), this report collects the partners' answers of the assessment of the impacts on data protection, other fundamental rights and the Trustworthy AI of the BAG-INTEL project and how the consortium is going to have an ethical and legal by design approach from the first steps.

Specifically, this deliverable:

1. Explain the concept of the tools used;
2. Describes the partners' knowledge about the risk they will face;
3. Provides key findings about Trustworthy IA, ELSIA and DPIA of the BAG-INTEL tools.

6.3 DOCUMENT STRUCTURE

This document is structured in four chapters. The second one is about the methodology used in task 2.2 of the BAG-INTEL project. The fourth is the Key finding of the questionnaires send to the partners.

6.4 APPLICABLE AND REFERENCE DOCUMENTS

Council of Europe:

- European Convention on Human Rights
- CETS 108 - Convention for the Protection of Individuals with regard to Automatic Processing of Personal Data

European Union:

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- Charter of Fundamental Rights of the European Union
- Regulation (EU) 2016/679 of the European Parliament and of the Council of 27 April 2016 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data, and repealing Directive 95/46/EC (General Data Protection Regulation, GDPR).
- Directive (EU) 2016/680 of the European Parliament and of the Council of 27 April 2016 on the protection of natural persons with regard to the processing of personal data by competent authorities for the purposes of the prevention, investigation, detection or prosecution of criminal offences or the execution of criminal penalties, and on the free movement of such data, and repealing Council Framework Decision 2008/977/JHA.
- Directive (EU) 2016/681 of the European Parliament and of the Council of 27 April 2016 on the use of passenger name record (PNR) data for the prevention, detection, investigation and prosecution of terrorist offences and serious crime.
- Regulation (EU) 2018/1861 of the European Parliament and of the Council of 28 November 2018 on the establishment, operation and use of the Schengen Information System (SIS) in the field of border checks, and amending the Convention implementing the Schengen Agreement, and amending and repealing Regulation (EC) No 1987/2006.
- Proposal for a Regulation of the European parliament and of the council laying down harmonised rules on artificial intelligence (artificial intelligence act) and amending certain union legislative acts.
- European Commission, H2020 Programme Guidance: How to complete your ethics self-assessment, Version 6.1, 4 Feb 2019. https://ec.europa.eu/research/participants/data/ref/h2020/grants_manual/hi/ethics/h2020_hi_ethics-self-assess_en.pdf
- European Commission, Annex 2: Ethics issues table – checklist, http://ec.europa.eu/research/participants/portal/doc/call/h2020/msca-rise-2014/1597696-ethics_issues_table__checklist_en.pdf

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7 ELSI, DPIA & TURSTWORTHY AI SCOPE AND METHODOLOGY

7.1 CONCEPT OF THE ELSIA, DPIA & TRUSTWORTHY AI

EU regulation and strategy in the digital world is based on risk prevention. It can be seen in the ethical guidelines for the use of data such as AI and in the different regulation created, such as the GDPR and the AI Act.

For these purposes it is necessary to create risk and impact assessments, which is what is intended to be done with this derivable. Impact assessment is a structured process of identifying the future consequences of a current or proposed action (impact prediction/forecasting) and assessing the likelihood and significance of those impacts (impact evaluation). The 'impact' is defined as the difference between what would happen with the action and what would happen without it.[1] The use of massive data and AI tools are not free of risk. The analysis of the risks and benefits of using these technologies allows us to have a clearer vision of the use of data and AI in order to achieve a use that is legitimized by society and complies with ethical and legal standards. On some occasions it will be necessary to balance these impacts and weigh which assets should prevail over others, having to make sacrifices in the use of the tools used by the BAG-INTEL.

The purpose of these impact assessment analyses is to identify ethical and legal problems, evaluating them from the perspective of the fundamental values and rights of a society in a democratic state. Ethical and legal impact assessments focus on the assessment of ethics in research an innovation procedure and anticipation, determination evaluation and prevention of the negative outcomes with the goal of get a responsible research and innovation.

7.2 NECESSITY OF ELSIA, DPIA & TRUSTWORTHY AI

Impact assessment methodologies are the solutions of the GDPR, Directive 2016/680 and the AI Act to prevent issues related to the use of personal data and artificial intelligence. ELSIA, DPIA and Trustworthy AI are tools the mitigate the bad use of personal data and artificial intelligence tools. BAG-INTEL is a research and innovation process, and its outputs incorporate big data analytics and artificial intelligence technologies into the context of security in airports.

Impact assessment, as methodology, lets to have a better understanding of the problems and issues that are going to raise in a research and innovation process, which leads to the success of the project with a better use of the data and the technology, a better understanding of the use of them in a particular contexts and detecting the issues before the problems become unsolved, with a anticipatory approach.

Starting the assessment from the first steps warranties an analysis of the impact with the goal of design the technology, in BAG-INTEL project, the intelligent scanner and the luggage tracking, in a way that respect citizens' rights and in an ethical way.

[1] The International Association for Impact Assessment, http://www.iaia.org/.

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7.3 SCOPE OF ELSIA, DPIA & TRUSTWORTHY AI AND ALIGNMENT WITH BAG-INTEL

The impact assessment distinguishes between internal impacts and external impacts. The first are the one related to conducting research of technology in the consortium (partners and research participants). The second is the impact of the technology on end users and society. Thus, the assessment will analyse the positive impacts (benefits) and the negative impacts (risks).
At the stage of the project will have made the assessment only with the technical partners to prevent the risks and to and highlight the positive impacts to reinforce them.

The document was originally marked PU. However, it is recommended that the document remains confidential because it is intended to assist the consortium partners in the development and delivery of the BAG-INTEL tools and as such, it contains extensive references to the technology design and development.

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8 BAG-INTEL METHODOLOGICAL APPROACH

8.1 BAG-INTEL ETHICAL & LEGAL TOOLS

GDPR, Directive 2016/680 and AI Act impose impact assessment systems as a new tool to prevent negative impacts on the citizens' rights. With this in mind, task 2.2 will ensure that the use of artificial intelligence and data respects ethical principles and fundamental rights and support and advise consortium partners on the ethical, legal and societal impacts of their activities within BAG-INTEL and collaborate with them to mitigate any adverse implications.

For this objective, we have developed three questionnaires, focusing on data impact assessment, ethical, legal and societal impact and an ethical use of artificial intelligence, that have been send to all technical partners in the consortium. The first round of these questionnaires has two main objectives: raise awareness among partners about the analysis of the technologies they are using and their legal requirements and a first approach to the problems that may be encountered in the development of the project BAG-INTEL.

Our ethics toolkit includes tools to identify and assess ethical, legal and societal issues raised by a project, and to monitor and implement ethics throughout its duration. The toolkit is aligned with the Ethics Appraisal Procedure under Horizon Europe Programme.

UGR had several online meetings with the partner to explain from the ethical and legal point of view the concepts and possible impacts of the different technologies to facilitate answering the questionnaires. These meetings aware the partner about possible risks linked to the technology that are going to implement in BAG-INTEL and let them think about possible solutions to mitigate them from the beginning of its implementation.

At the same time, these interviews let the people involved in task 2.2 to monitoring the ethical, legal and social aspects of the project with a tailor-made version of the general questionnaire. Thus, to complain with the ethical principles of artificial intelligence, we had adapted the questionnaire made by the High Level Expert Group on artificial intelligence of the European Commission to the needs of the BAG-INTEL's intelligence technologies, achieving compliance with the seven principles of the artificial intelligence: human oversight and control, safety and security, data governance and privacy, transparency, diversity, non-discrimination and fairness, societal and environmental well-being and, accountability.

In a second round in the middle of the project, with the real implementation of the technologies, the outcomes of the ethical and legal monitoring will be more accruable.

8.2 EVALUATION CRITERIA OF ELSIA, DPIA AND TRUSTWORTHY AI

The three questionnaires have a description of the technology implemented in BAG-INTEL and, each one, has its own approach to the ethics and legal issues.

8.2.1 Ethical, legal, and societal impact assessment

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The questions of the ELSIA questionnaire pretend to analysis:

1. Ethical impacts that have relevance to the implementation of the technology in the prototype.
2. Legal impacts about the human rights, data use regulations and AI Act
3. Societal impacts such as freedom of movement, privacy, security, and freedom.

Once the partners describe the impacts, the make an assessment to evaluate the intensity of the impact, if it is good o bad and, in this case, how they are going to mitigate it. To realise this assessment, first they describe the technology that is going to be used, the context, and take them into account to design the tool.

The questionnaire focuses on criteria as use data proportionality, the right of privacy and security, the right to non-discrimination, the right to security, and the right to protection of personal data. Also, social values as dignity, equality, solidarity, justice, proportionality, and freedom are in the table of the discussion with the technical partners.

The risk will be evaluated as positive and negative, the probability of occurrence, and its intensity. As the project is a security one, that means that, for the right use of the data and the goals of the project, some trade-offs must be made. In that case, the partners give information about the solution implemented to solve the problem. For example, to ensure security at the airport installation, the use of data could be less proportionate as in other contexts. Thus, Xray images can show more information than only the object searched, but this information will not use to give a positive outcome.

8.2.2 Privacy and data protection impact assessment

DPIA consist in process to control the use of data. In our case, the data provided by LEAs are essential, but it is use by non-LEA partners is complicated. The idea is, collaborating with task 1.4 (data management plan), Is to manage the potential impact of the use of the data on privacy. There are several different norms about the use of the data in this kind of projects linked to security. LEAs can use the data under the Directive 2016/680 of the European Parliament and of the Council of 27 April 2016 on the protection of natural persons with regard to the processing of personal data by competent authorities for the purposes of the prevention, investigation, detection or prosecution of criminal offences or the execution of criminal penalties, and on the free movement of such data, and repealing Council Framework Decision 2008/977/JHA, while the rest of the partners are under the scope of the GDPR. The use of PNR and SIS II data are under the scope of the Directive (EU) 2016/681 of the European Parliament and of the Council of 27 April 2016 on the use of passenger name record (PNR) data for the prevention, detection, investigation and prosecution of terrorist offences and serious crime and the Regulation (EU) 2018/1862 of the European Parliament and of the Council of 28 November 2018 on the establishment, operation and use of the Schengen Information System (SIS) in the field of police cooperation and judicial cooperation in criminal matters, amending and repealing Council Decision 2007/533/JHA, and repealing Regulation (EC) No 1986/2006 of the European Parliament and of the Council and Commission Decision 2010/261/EU.

This scope is complicated to deal with because the different regulation, the different actors, and the different year of be in force, with reference to the precedent data protection norm of the GDPR. For this project the LEAs will provide or generated data or anonymised data, but not real. And the images will focus only on the luggage and not the persons.

The GDPR introduces a requirement around particular types of processing of personal data – the Data Protection Impact Assessment (DPIA). As stated in Recital 84 of the GDPR, for certain types of personal

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data processing that can pose a high level of risk to the rights of data subjects, an impact assessment exercise must be conducted prior to starting that processing:

> *Recital 84: In order to enhance compliance with this Regulation where processing operations are likely to result in a high risk to the rights and freedoms of natural persons, the controller should be responsible for the carrying-out of a data protection impact assessment to evaluate, in particular, the origin, nature, particularity and severity of that risk. The outcome of the assessment should be taken into account when determining the appropriate measures to be taken in order to demonstrate that the processing of personal data complies with this Regulation. Where a data-protection impact assessment indicates that processing operations involve a high risk which the controller cannot mitigate by appropriate measures in terms of available technology and costs of implementation, a consultation of the supervisory authority should take place prior to the processing.*

Article 34 of the GDPR provides more detail:

> *Where a type of processing in particular using new technologies, and taking into account the nature, scope, context and purposes of the processing, is likely to result in a high risk to the rights and freedoms of natural persons, the controller shall, prior to the processing, carry out an assessment of the impact of the envisaged processing operations on the protection of personal data. A single assessment may address a set of similar processing operations that present similar high risks.*

The Article 29 Data Protection Working Party provides guidance on whether a DPIA is required.[2] These were later endorsed by the EDPB. They present nine criteria as follows, and suggest that if a processing operation matches two or more of these criteria, then a DPIA should be conducted:

- Evaluation or scoring, including profiling and predicting, especially from aspects concerning the data subject's performance at work, economic situation, health, personal preferences or interests, reliability or behaviour, location or movements.
- Automated-decision making with legal or similar significant effects.
- Systematic monitoring: processing used to observe, monitor or control data subjects, including data collected through networks. This type of monitoring is a criterion because the personal data may be collected in circumstances where data subjects may not be aware of who is collecting their data and how they will be used.
- Sensitive data or data of a highly personal nature (including both Special Categories of personal data as set out in Art.9. and categories commonly understood as sensitive).
- Data processed on a large scale (number of subjects, proportion of population, volume of data, duration or permanence, geographical extent of the processing.
- Matching or combining datasets – for example originating from two or more data processing operations performed for different purposes and/or by different data controllers in a way that would exceed the reasonable expectations of the data subject.
- Data concerning vulnerable subjects.
- Innovative use or applying new technology or organisational solutions.
- When the processing itself prevents data subjects from exercising a right or using a service or contract (e.g. screening against a credit reference database).

There are also exemptions that mean that a DPIA is not required. These exceptions include:

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[2] Article 29 Data Protection working party Opinion WP248 Guidelines on Data Protection Impact Assessment (DPIA) and determining whether processing is "likely to result in a high risk" for the purposes of Regulation 2016/679.

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- where the processing is not "*likely to result in a high risk to the rights and freedoms of natural persons*" (Article 35(1));
- when the nature, scope, context and purposes of the processing are very similar to the processing for which DPIA have been carried out. In such cases, results of DPIA for similar processing can be used (Article 35(1)18);
- where a processing operation has a legal basis in EU or Member State law and has stated that an initial DPIA does not have to be carried out, where the law regulates the specific processing operation and where a DPIA, according to the standards of the GDPR, has already been carried out as part of the establishment of that legal basis (Article 35(10))19;

where the processing is included on the optional list (established by the supervisory authority) of processing operations for which no DPIA is required (Article 35(5)20). Such a list may contain processing activities that comply with the conditions specified by this authority, in particular through guidelines, specific decisions or authorisations, compliance rules, etc.

Although, the use of personal data is avoided in the scanner and in the knowledge repository (PNR and SIS II data will be not real or anonymous) in the tracking of the luggage can be personal data because the images of the luggage at the airport can have faces that are not going to be processed. And this can be a risk and, for this reason, DPIA is necessary.

The DPIA will focus on large scale processing, automated-decision making with legal effects, matching or combining datasets, processing of data relating to criminal records, systematic monitoring of luggage, and innovative use of technology.

The main idea is to mitigate the negative risk of the use of data in the monitoring of luggage at airport to avoid smuggling, always under the control of LEAs.

8.2.3 Trustworthy artificial intelligence assessment

In the BAG-INTEL project there are several uses of artificial intelligence tools. Hence, we are going to follow the Ethical guidelines of the High expert group of the European Commission[3]. In this document we can find a questionnaire about the ethical use of artificial intelligence tools.

It focuses on the seven principles of artificial intelligence: human agency and oversight, technical robustness and safety, privacy and data governance, transparency, diversity, non-discrimination and fairness, societal and environmental well-being, and accountability. Of course, this questionnaire has been adapted to the needs and technologies of the BAG-INTEL project. The questionnaire is very precises and not all the questions apply to the project and the time development of the tasks, at the moment that we are gathering the information of the participants.

The first approach has the intention of control the risk related to the different technologies from the first steps of the project to follow a *by design* approach.

[3] High level expert group, Ethics guidelines for trustworthy AI, European Commission, 2019.

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9 KEY FINDINGS OF THE END USERS, LEGAL AND ETHICAL REQUIREMENTS

9.1 LEGIND TECHNOLOGIES AS (LTA)

9.1.1 DESCRIPTION OF THE TECHNOLOGY

The technical team in T4.1 will develop (a) a module for analysing external data for risk indicators, and (b) a module for finding risk indicating connections between travellers and criminal activity as registered in LEA databases. The technical team in T4.3 will develop modules for visualisation of real-time decision support; the visualization will not be product matured (which would include use of usability analysis and test) but be sufficient for proof-of-concept.

9.1.2 SUMMARY ELSIA

The potential conflict identified in the project is the balancing act between privacy and security principles. Therefore, it will be necessary to consider these potential conflicts to establish a good balance that does not compromise these fundamental rights. In this regard, the actions to be taken will aim to handle data in a manner sufficient for the proper functioning of the system. The goal is not to pursue the highest possible precision at the expense of privacy but rather to achieve sufficient and effective precision to ensure the system operates effectively.

9.1.3 SUMMARY DPIA

9.1.3.1 Principles for proper data processing

Personal data, defined as information that could identify an individual, will not be processed. The data received will originate from other BAG-INTEL project participants, and it is expected to be anonymized to ensure no individual can be identified. From Law Enforcement Agencies (LEAs), data concerning to traveller and SIS II will be obtained, also expected to be anonymized.

No profiling, scoring, or evaluations will be conducted regarding aspects such as the data subject's work performance, economic status, health, personal preferences, interests, reliability, behaviour, location, or movements. The main objective is to assess the risk of travellers connected to luggage. Automated decisions with legal effects will be made based on the received data. An indicator based on colours (green, yellow, and red) will be developed to signify luggage risk.

No data concerning race or ethnic origin, political opinions, religious or philosophical beliefs, trade union membership, genetic data, biometric data for individual identification, health data, or information regarding a person's sex life or sexual orientation will be processed. Therefore, only the minimum necessary data will be collected, limited to what is necessary for re-identification purposes, and any images containing people's faces will be deleted.

9.1.3.2 Actions to Data Protection Principles

The processing of personal data will be conducted lawfully, fairly, and transparently through privacy and data protection assessments in accordance with GDPR guidelines. Privacy and respect for personal information will be ensured, and legal experts within the project BAG-INTEL will be consulted for these matters.

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Data collection will be limited to only those necessary for re-identification training, with all unnecessary information, such as people's faces, being deleted. Measures will be taken to uphold data privacy. Storage of personal data will be restricted to the project's purpose, with all collected data being deleted once objectives are met. There is a possibility of retaining a sample of anonymized data for scientific publications. Personal data storage will not be conducted by this participant; rather, data will be obtained from another participant, PSI. Consideration is being given to hosting this information on a secure cloud system.

9.1.3.3 Risk in the use of personal data and solutions

There may be a low probability of privacy implications in data processing; however, any impact would be of low intensity. To mitigate this potential impact on the project, anonymization of data is planned through the responsible party, Henrik Larssen. This action would significantly reduce the risk.

9.1.4 SUMMARY ETHICS OF AI

9.1.4.1 Human agency and oversight

An Artificial Intelligence system will be implemented in carrying out tasks for this participant. A designated individual for overseeing this system has not yet been assigned. However, it is believed that the planned AI system will enhance and improve human capabilities in task execution. To prevent potential risks stemming from overconfidence or overreliance on the AI, Learning Loops will be conducted, gathering feedback from other project participants. Manipulation and control of the AI system will aim for proper functioning during its development, which will determine the level of human intervention in the process.

9.1.4.2 Technical robustness and safety

This section could not be assessed as the technology is in its initial stages and has not yet been developed.

9.1.4.3 Privacy and data governance

Personal data will not be collected; rather, data provided by other project participants like LEAs will be utilized. It is expected that data will be received anonymized and of the desired quality; however, if not, conflicts that may arise regarding privacy and protection of the data will need to be addressed, and methods for anonymization will be determined.

Simultaneously, measures will be taken to enhance privacy, such as encryption, anonymization, and aggregation. The coordinator will be responsible for implementing these measures and will act as the Data Protection Officer (DPO) from the outset of the process.

Access to the data will also be governed by a series of measures. Users who can access the data and under what circumstances will be determined. For example, access to images will be granted to the AI expert. Those accessing and processing the information will be qualified and briefed on the process by the designated personnel. Mechanisms for data access are being considered, likely involving establishing a registry.

9.1.4.4 Transparency

- Traceability:

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It is ensured that tracing will not be possible as data is received anonymized, preventing tracing back to an initial point. No measures are required to prevent this possibility during development.

- Explainability:

Decisions made by the system will streamline the organization's decision-making process, enhancing risk identification and assessment. The outcomes generated by the AI system can be reviewed and the machine's performance scrutinized from the outset to ensure adequacy. Upon system implementation, an explanation will be provided for why certain decisions yield specific results. Consideration for AI interpretability has been integrated from its initial development, aiming for a simple and interpretable model. The assessment of the tool's interpretability will be feasible even after development.

- Communication:

As part of the user interface, end users will understand the reasons and criteria behind the AI's results. These results will be communicated clearly to the audience. Testing has begun to receive feedback on the final tool and adapt the system to user needs. This process will be kept confidential from other audiences, third parties, or the general public as much as possible. Characteristics, limitations, and potential shortcomings of the AI system will be communicated to end users as part of the communication process.

9.1.4.5 Diversity, non-discrimination and fairness

In this case, there are no perceived risks of discrimination in this procedure, as the purpose is to establish risk assessments based on data that will be anonymized and provided by other participants.

9.1.4.6 Societal and environmental well-being

The tool is still in the development phase, so measures aimed at reducing the impact of the AI system have not yet been anticipated.

9.1.4.7 Accountability

Regarding accountability, mechanisms are planned to ensure traceability and logging of the AI system throughout the process and its outcomes. It has been ensured that in applications affecting fundamental rights, including those critical for security, the AI system can be independently audited. An assessment of the risk or impact of the AI system has been conducted, considering various directly affected stakeholders. Although training and education for developing accountability practices have not yet been provided, it is considered feasible to implement them in the future. This training could encompass the legal framework applicable to the AI system.

Additionally, a mechanism has been established to identify relevant interests and values implicated by the AI system and potential trade-off among them. Trade-off decisions have been documented.

9.2 COMMISSARIAT À L'ÉNERGIE ATOMIQUE ET AUX ÉNERGIES ALTERNATIVES (CEA)

9.2.1 DESCRIPTION OF THE TECHNOLOGY

The CEA luggage detection and re-identification system utilizes AI models to detect luggage within images extracted from video streams. These models analyse the appearance of detected bags and compare them to identify the most similar bags from a query image. This process enables efficient and

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accurate identification and tracking of luggage across various scenarios and environments captured by video surveillance systems.

9.2.2 SUMMARY ELSIA

The implemented technology in BAG-INTEL offers a significant positive impact, where the detection and re-identification of luggage can enhance customs control for law enforcement, particularly in detecting contraband and illicit substances. This positive impact is characterized by a likelihood rating of 4 and an intensity rating of 5, indicating a substantial probability and a high severity of impact, respectively.

Other positive impact is the detection and re-identification of luggage that can enhance customs control and airport security beyond the BAG-INTEL use case. This positive impact is characterized by a likelihood rating of 3 and an intensity rating of 3, indicating a moderate probability and a moderate severity of impact, respectively.

The implemented technology in the project poses a potential negative impact as well. This negative impact involves privacy concerns due to the acquisition of video streams where people can be inadvertently viewed and possibly recognized, despite the technology's primary focus on luggage detection and re-identification. This risk is characterized by a likelihood rating of 5, indicating a high probability, and an intensity rating of 5 during the project phase when researchers are utilizing the videos. During the operational phase, if the police or customs employ such a system, the intensity rating decreases to 3, signifying a moderate severity of impact.

In the BAG-INTEL project, a conflict arises between privacy and security/law enforcement. On one hand, there is a need to ensure the privacy of individuals whose images may be captured in the video streams, addressing concerns about unauthorized surveillance. On the other hand, there is a necessity to maintain security and enable law enforcement agencies to effectively detect contraband and illicit substances. To resolve this conflict, two solutions are proposed: Solution 1 involves restricting access to the video streams solely to law enforcement agencies during the operational phase. Bag-Intel partners can access and process the videos during the project development phase, provided that passengers are informed and GDPR compliance is ensured. Solution 2 suggests the use of human face anonymization techniques to safeguard privacy. This solution ensures that personal identifiable information is obscured in the video streams, thus mitigating privacy concerns while still enabling effective security measures.

With Solution 1, the impact is reduced by ensuring that the use of personal data is tracked and disclosed, thereby promoting transparency and accountability. Responsibility for this action lies with the airport/customs authorities, who permit the installation of cameras and the recording of video streams. Solution 2 mitigates the problem by eliminating the use of personal data through human face anonymization, thereby safeguarding privacy. The responsibility for this action lies with the entities responsible for video recording, such as PSI, airport/customs, or INTRA, which own the video recording and storage infrastructure.

After the application of the solution, the risk rating for Project impact: Positive #1 remains at a likelihood of 4 for both Solution 1 and Solution 2. However, the intensity varies: for Solution 1, it remains at 5, indicating a high impact, while for Solution 2, it ranges from 3 to 5, considering the potential degradation in image quality due to human face anonymization. The risk rating for Project impact: Positive #2 remains unchanged, with a likelihood of 3 and an intensity of 3. The risk rating for

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Project impact: Negative #1 decreases with Solution 1, with a likelihood of 3, and an intensity of 5. With Solution 2, the likelihood decreases to 1, and the intensity decreases to 3.

9.2.3 SUMMARY DPIA

9.2.3.1 Principles for proper data processing

If all data received from acquisition teams is anonymized, the project will not process personal data. However, if no anonymization is performed, the project will involve processing personal data. During the data annotation phase for AI training, video streams with human faces may be incidentally present, but the project will not focus on processing such personal data. Instead, the primary focus will be on detecting and extracting luggage. In the development phase, the project will train the model using videos that may contain persons, but the emphasis will remain on detecting luggage. Any human faces present in the video can be anonymized (masked) to protect privacy.

The technology will not process LEAs' data such as ID numbers, criminal records, or terrorist labelling. Only images of bags will be processed.

There will be no evaluation or scoring, including profiling and predicting, especially concerning the data subject's performance at work, economic situation, health, personal preferences or interests, reliability or behaviour, location or movements. Only images of bags are processed.

There will be no automated decision-making with legal effects for legal purposes. The module will return a ranking of the most similar bags with a query image of a bag. From this ranking and the fusion module (WP4), alerts will be given to the user (customs). Thus, the entire decision will be made by the human operator.

There will be no processing of data revealing racial or ethnic origin, political opinions, religious or philosophical beliefs, or trade union membership, nor the processing of genetic data, biometric data for the purpose of uniquely identifying a natural person, data concerning health, or data concerning a natural person's sex life or sexual orientation. Only images of bags will be processed. Also they will not use biometric data such as fingerprints or face recognition for tracking passengers.

They are committed to processing the minimum data necessary for the task. Regardless of whether anonymization processes are used, their modules will not focus on any potentially present personal data. The primary objective is to achieve optimal performance in luggage re-identification, with no involvement of personal data.

9.2.3.2 Actions to Data Protection Principles

In adherence to the principles of lawfulness, fairness, and transparency in data processing all video data received from acquisition teams undergoes either anonymization or is recorded in compliance with GDPR regulations and passenger information standards to ensure transparency. This approach has positive impacts, as anonymization eliminates the storage and processing of personal data, while in cases where anonymization is not feasible, personal data, such as faces, is not processed or stored during operational or demo phases. However, during the annotation phase for AI training, if anonymization is not carried out, images received by annotators may contain personal data. To ensure compliance, measures such as anonymization techniques and adherence to GDPR regulations and passenger information standards are implemented.

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Aligned with the principle of purpose limitations, the action strictly defines the purpose of acquiring video data solely for the analysis of baggage appearance, encompassing detection and re-identification tasks. Moreover, these acquisitions serve broader scientific and public interest objectives, facilitating research advancement and supporting law enforcement efforts. The positive impacts include fostering research progress and aiding law enforcement endeavours. To ensure compliance, access to the videos is restricted to project researchers only, with processing activities exclusively targeting luggage for contraband detection purposes.

Adhering to the principle of data minimisation, the action ensures that personal data is not processed, although it may be incidentally present during the bag annotation phase if anonymisation was not conducted beforehand. This approach mitigates risks associated with personal data handling. Measures to ensure compliance include the implementation of data anonymisation techniques and the use of a restricted dataset for annotation and AI training purposes.

In relation to the principle of accuracy, the action recognizes that faces may be the only personal data potentially visible in the images, but that they are not the subject of processing. As such, accuracy is not a relevant factor in this context.

Regarding to the principle of storage limitation, the action ensures that no personal data, specifically faces, will be stored. Personal data, if present in the images, will only be visible during the annotation phase if anonymization has not been performed. However, as only images of bags will be retained at the end of the annotation process, no personal data will be stored. This measure ensures compliance by ensuring that the original images, potentially containing personal data, are not retained after the annotation process is completed.

Adhering to the principle of integrity and confidentiality, if anonymization is applied, there are no concerns for our modules. However, if anonymization is not performed, confidentiality must be ensured during the annotation phase. This measure aims to uphold confidentiality by ensuring secure access to the original images, which may contain faces, used during the annotation process.

In alignment with the principle of accountability, measures have been established to ensure traceability of received datasets for annotation, particularly in cases where anonymization has not been performed. This traceability serves to demonstrate that no personal data was retained after the annotation process was completed. Additionally, the functionalities performed by various processing components will be demonstrated to confirm that only bag-related data is processed, with no involvement of personal data. These measures aim to uphold accountability throughout the data processing pipeline.

9.2.3.3 Risk in the use of personal data and solutions

The use of video streams for data acquisition poses a privacy risk due to the potential presence of individuals who may be recognizable in the images. This could lead to privacy concerns, particularly during the project phase when researchers are utilizing the videos. The likelihood of this risk materializing is rated at 5, indicating a high probability. Furthermore, the intensity of the risk is rated at 5 during the project phase, signifying a significant impact on privacy. However, during the operational phase, if the system is utilized by law enforcement agencies such as the police or customs, the intensity of the risk decreases to 3, although the likelihood remains high.

Regarding the solutions proposed to mitigate the problems: The first solution involves restricting access to the video streams only to law enforcement agencies (LEAs) during the operational phase, while during the project development phase, access is granted to BAG-INTEL partners under the condition of informing passengers and ensuring GDPR compliance. This approach reduces the impact

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by ensuring that the use of personal data is tracked and declared, thereby enhancing transparency and accountability. The responsibility for this action lies with the airport/customs authorities, who allow the installation of cameras and the recording of streams. The second solution proposes the use of human face anonymization to further safeguard privacy. By anonymizing human faces in the video streams, personal data is not utilized, thereby mitigating privacy risks. The responsibility for implementing this action falls on the entity responsible for video recording, which could be PSI, airport/customs, or INTRA, depending on ownership of the video recorder and storage infrastructure.

After the application of the proposed solutions, the risk associated with privacy impact is significantly mitigated: For Solution 1, the likelihood of privacy concerns is reduced to 3, as access to video streams is restricted to authorized entities, enhancing control over personal data usage. The intensity remains at 5, reflecting the potential privacy impact during the project phase when researchers use the videos. However, during the operational phase, where only LEAs have access, the intensity decreases to 3, as strict protocols and oversight are in place. For Solution 2, both the likelihood and intensity of privacy risks decrease substantially. The likelihood decreases to 1, indicating a low probability of privacy concerns arising due to the anonymization of human faces. Similarly, the intensity decreases to 3, reflecting the reduced severity of privacy implications when personal data is anonymized.

9.2.4 SUMMARY ETHICS OF IA

9.2.4.1 Human agency and oversight

Human agency and oversight are integral to the AI system's operation. During AI training, human oversight is ensured through the control of performance metrics and the tuning of AI parameters. When utilizing the AI, the system generates rankings of the most probable matches for baggage re-identification, which are then passed to the WP4 module for fusion and decision-making support. Crucially, the AI system itself does not make any final decisions; instead, it empowers human operators to make informed decisions, thereby maintaining human control and preventing overreliance on AI.

9.2.4.2 Technical robustness and safety

Technical robustness and safety are paramount considerations for any visual AI system. One potential vulnerability is data pollution, such as adversarial attacks involving objects with specific patterns designed to deceive the AI. However, the system's reliance on human operators for decision-making significantly mitigates these vulnerabilities. By placing decision-making authority in human hands, the impact of potential vulnerabilities is reduced, as human supervision provides an additional layer of oversight and judgment to safeguard against adverse effects stemming from technical vulnerabilities.

9.2.4.3 Privacy and data governance

Privacy and data governance are essential considerations for the implementation of this technology. Proper anonymization of data is crucial to ensure compliance with privacy regulations. If data is anonymized correctly, privacy concerns are minimized, as the method only requires baggage images and videos, without the use of personal data. However, in cases where anonymization is not performed, it is necessary to inform passengers about the use of their data. During the annotation phase, personal data, such as faces, may be present in the images if anonymization is not applied. However, only images of bags are retained at the end of the annotation process, ensuring that no personal data is stored. This approach helps to maintain privacy and data governance standards throughout the project.

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9.2.4.4 Transparency

Transparency is maintained through the measurement of accuracy, which is assessed by ranking the most similar baggage matches based on a similarity score order. This ranking serves as assistance for human operators in making decisions. The process can be explained through the visualization of images of the bags along with their corresponding similarity scores. By providing visibility into the decision-making process, transparency is ensured, allowing stakeholders to understand how decisions are made and promoting trust in the system.

9.2.4.5 Diversity, non-discrimination and fairness

Diversity, non-discrimination, and fairness considerations are not applicable as the method does not involve the processing of personal data. Therefore, there are no functionalities related to these aspects within the system.

9.2.4.6 Societal and environmental well-being

The societal and environmental well-being aspects of the project are positively impacted by the implementation of the AI technology. The AI training utilizes lighter model architectures, resulting in reduced costs. Additionally, the AI inference during the operational phase is also cost-effective. Furthermore, the fight against contraband facilitated by the technology contributes to societal well-being by enhancing security measures.

9.2.4.7 Accountability

The project ensures accountability through traceability mechanisms such as model metrics, rankings, and potential visualizations of similar bag images. By leaving decision-making to human operators, the model promotes accountability and transparency in its processes.

9.3 UNIVERSITY OF GRANADA (UGR)

9.3.1 DESCRIPTION OF THE TECHNOLOGY

The University of Granada (UGR) team oversees two technologies:

1) Name of the technology: (T2.4) BKB Bag-Intel Knowledge Base

Description: The BKB Knowledge base will be the main knowledge base of the project. It will store the selected information from different databases (like those suggested in T4.1). This information can include data from passengers, flights, contraband, luggage, and other information that the consortium might consider.

2) Name of the technology: (T4.5) Decision support system assistant

Description: Machine learning techniques will be employed to assist customs and LEAs in the decision-making process. This tool will offer a recommendation for physical inspection of the bag based on the assigned risk levels coming from (T4.2) and other parameters.

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9.3.2 SUMMARY ELSIA

Technology can have both positive and negative impacts on BAG-INTEL. On one hand, there is a high probability of a positive impact due to streamlined and secure information utilization in decision-making, with this impact being of high intensity. Additionally, automation, organization, and data consultation in the project, as well as data security, privacy, and protection, will also have a positive impact.

As for potential negative impacts the tool might have on BAG-INTEL, it could affect equality and privacy, although the probability of this is very low, and if it were to occur, the intensity would also be very low.

Exploring potential conflicts in the BAG-INTEL project, one could be the need to prioritize between security and privacy. To address this, a system of access control is envisaged, limiting the people and content that can be accessed. On the other hand, the possibility of conflicts arising regarding equality will be reduced due to prior exploration to detect potential biases, as well as the analysis of the output that could be obtained from the proposed algorithm. The researchers responsible for developing these solutions are Karel Gutiérrez Batista and Bartolomé Ortiz Viso.

It is anticipated that the implementation of the solutions will have positive impacts. However, at this stage of technology development, the extent of these impacts cannot be accurately assessed.

9.3.3 SUMMARY DPIA

9.3.3.1 Principles for proper data processing

Regarding data processing, the team at University of Granada (UGR) will not process personal data, as anonymized data is expected to be provided. The quality and type of data will be received from LEAs, and anonymized data is anticipated. The development of scoring, including profiling and prediction, will be carried out by the UGR team concerning airplane and travellers' data in anonymized form. In this regard, automated decisions made will aim to select those suitcases requiring inspection. No personal data revealing racial or ethnic origin, political opinions, religious or philosophical beliefs, or trade union membership, and no processing of genetic data, biometric data for uniquely identifying a natural person, or data concerning health or a person's sex life or sexual orientation, will be processed. Efforts will be made to process the minimum amount of data necessary for the task being developed. Only data aimed at improving the tool's design will be stored, not for further exploitation.

9.3.3.2 Actions to Data Protection Principles

Data processing will be carried out lawfully, fairly, and transparently, respecting the principles of anonymity, security, privacy, and equality. To achieve this, access control will be established to ensure privacy and security by design.

Data storage will be done for a specific, explicit, and legitimate purpose, in accordance with the information service to the consortium. Measures will be taken to increase privacy and transparency, including ensuring privacy and security by design and access control through registration (login) of individuals who may access the data. Measures are being developed to ensure transparency in decision-making.

Data will be processed according to the principle of minimizing personal data, ensuring that processing is adequate, relevant, and limited to what is necessary for the purpose. Therefore, only personal data

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required by the consortium will be stored in a repository form. Minimizing data will contribute to greater efficiency, as a smaller amount of data leads to better performance of the information system. No information support will be used for this purpose.

Regarding accuracy, data updates or removal of incomplete data will not be necessary, as anonymized data will be received. In case of any issues, the contact email of the team has been made available to the law enforcement agencies (GUCI). This approach aims to achieve a more reliable database and greater control over it.

Personal data storage will be deleted when no longer necessary, with deletion occurring the agreement of the DMP. Prior to deletion, all data that is not necessary for the intended purpose and any requested data will be removed. This will improve system functionality and result in resource savings.

The integrity and confidentiality of personal data will be ensured to keep them safe and protected against unauthorized or unlawful processing, as well as accidental loss, destruction, or damage, using appropriate technical or organizational measures. Highly reliable data sources, with minimal or no errors, will be utilized, and backups will be developed while leveraging the security systems of University of Granada, including access controls. These measures will provide a high level of data reliability.

Finally, regarding accountability or the ability to demonstrate compliance with the law, a designated contact person or Data Protection Officer (DPO) will be established within the University of Granada team, ensuring compliance with regulatory requirements and enabling the demonstration of actions taken and their effectiveness when requested.

9.3.3.3 Risk in the use of personal data and solutions

In terms of risks associated with the use of data, there is a moderate risk of false positives or false negatives occurring in the decision support system, albeit with low intensity. Additionally, there is a moderate risk of biases appearing in the output, with the intensity of this risk also being moderate. To minimize the probability of these risks arising, several solutions are proposed. Firstly, potential false positives and false negatives in the decision support system will be carefully observed beforehand to prevent system errors and ensure early detection for balanced improvement and validation. Secondly, the system's learning will continue over time to enhance its performance and results. Finally, users will be informed in advance about the system's margin of error, improving user decision autonomy and decision explanation.

The researchers responsible for developing these solutions will be Karel Gutiérrez Batista and Bartolomé Ortiz Viso. Once these solutions are implemented, the risk of false positives and false negatives in the system is expected to be very low, with the intensity of this risk also being very low if it were to occur. Similarly, the risk of bias in the output is expected to be very low, with very low intensity.

9.3.4 SUMMARY ETHICS OF AI

9.3.4.1 Human agency and oversight

The AI system is implemented in the decision-making task. Task allocation between the AI system and humans has been considered to ensure meaningful interactions and appropriate human oversight and control, with the system not making decisions automatically. The AI system enhances human

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capabilities by augmenting the information used in the decision-making process. Safeguards have been implemented to prevent overconfidence in or overreliance on the AI system for work processes, including the use of a non-categorical decision system and providing users with warnings about the level of accuracy.

The appropriate level of human control for the particular AI system and use case has been considered. The level of human control or involvement is significant. While there is control over the system, the involvement is relatively low because the user only utilizes the information provided by the system to make a decision. The "human in control" includes law enforcement agencies (LEAs) or end users who have access to the system's output for decision-making purposes. Mechanisms and measures have been put in place to ensure human control or oversight. The system assists but does not recommend decision-making, leaving the ultimate control in the hands of the human users.

There is no self-learning or autonomous AI system or use case in this scenario.

9.3.4.2 Technical robustness and safety

- Resilience to attack and security

Potential forms of attacks to which the AI system could be vulnerable have been assessed under the University of Granada (UGR) safety and security measures. Various types and natures of vulnerabilities, including data pollution, physical infrastructure, and cyber-attacks, have been considered in the analysis. Since the system does not learn automatically, errors are avoided, and there are no external sources that could cause harm. Measures and systems have been implemented to ensure the integrity and resilience of the AI system against potential attacks, under the guidance of UGR.

The level of risk raised by the AI system in this specific use case does not apply.

The likely impact of a failure of the AI system has been estimated, particularly when it provides incorrect results, becomes unavailable, or delivers societally unacceptable outcomes, such as discrimination. Measures have been implemented to control the outcomes through human intervention. Since it is a decision support system, its failure does not exacerbate the situation.

- Accuracy

The level and definition of accuracy required in the context of the AI system and its use case have been assessed. Due to the reliability of the data sources, the expectation is that false data will not be encountered. However, a specific metric for accuracy has not been established yet. Measures to measure and assure accuracy have not been implemented at this stage. Nevertheless, steps have been taken to ensure that the data used is comprehensive and up to date, with law enforcement agencies (LEAs) responsible for updating the data.

- Reliability and reproducibility

A strategy has been implemented to monitor and test whether the AI system is fulfilling its goals, purposes, and intended applications.

9.3.4.3 Privacy and data governance

- Respect for privacy and data Protection

Mechanisms have been established to allow others to flag issues related to privacy or data protection in the AI system's processes of data collection and processing. Additionally, the type and scope of data in the datasets have been assessed to ensure compliance with privacy regulations. Efforts have been

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made to develop the AI system or train the model with minimal use of potentially sensitive or personal data. Privacy-enhancing measures such as encryption, anonymization, and aggregation have been implemented to protect data. Moreover, where a Data Privacy Officer (DPO) exists, this person has been involved at an early stage in the process to ensure adherence to privacy standards.

- Quality and integrity of data

Oversight mechanisms have been established for data collection, storage, processing, and use to ensure compliance with regulations and standards. Additionally, processes have been implemented to ensure the quality and integrity of the data utilized in the AI system. While no other processes have been considered, the data sets are verified to have not been compromised or hacked through careful sourcing from Law Enforcement Agencies (LEAs), which provide reliable and secure data.

- Access to data

To manage and ensure proper data governance, we followed protocols outlined in the Data Management Plan (DMP) and complied with the Data Protection Officer (DPO) requirements. While we did not assess who can access users' data and under what circumstances, we ensured that individuals accessing the data were qualified and required to do so, possessing the necessary competences to understand data protection policies. Additionally, an oversight mechanism was implemented to log access to data, capturing details such as when, where, how, by whom, and for what purpose data was accessed, ensuring transparency and accountability in data usage.

9.3.4.4 Transparency

- Traceability

Traceability measures were not established as they were not applicable.

- Explainability

Assessment of the extent to which the decisions and outcomes made by the AI system can be understood was not applicable in this case. However, the system's decision was found to have a low influence on the organization's decision-making processes. The reasons for deploying this particular system in the specific area were not assessed as they did not apply.

The team researched and opted to utilize the simplest and most interpretable model possible for the application in question, ensuring ease of understanding for end users. Additionally, they assessed their ability to analyse both training and testing data, as well as their capacity to change and update this data over time. Furthermore, they evaluated their ability to examine interpretability after the model's training and development, ensuring access to the internal workflow of the model.

- Communication

Mechanisms to inform end-users about the reasons and criteria behind the AI system's outcomes were not established as they were not applicable.

This technology did not involve the clear communication of the characteristics, limitations, and potential shortcomings of the AI system as this aspect was not applicable.

9.3.4.5 Diversity, non-discrimination and fairness

- Unfair bias avoidance

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The technology did not involve the use of real data, thus eliminating the need for establishing a strategy or procedures to avoid creating or reinforcing unfair bias in the AI system.

Due to a lack of information, no assessment was conducted regarding possible decision variability that could occur under the same conditions.

- Accessibility and universal design

The accommodation of a wide range of individual preferences and abilities was not applicable and therefore not considered, as there was no relevant data available.

The impact of the AI system on the potential user audience was taken into account, with efforts made to ensure representation from all groups. An assessment was conducted to determine if there could be individuals or groups disproportionately affected by negative implications. In such cases, technical adjustments can be made to balance the dataset and mitigate potential adverse effects.

- Stakeholder participation

The participation of different stakeholders was considered in the development and use of the AI system, with a particular emphasis on involving only police forces.

9.3.4.6 Societal and environmental well-being

In response to the question regarding the establishment of mechanisms to measure the environmental impact of the AI system's development, deployment, and use, it was indicated that there were no such mechanisms in place due to the lack of competence in this area. Instead, the university policies were referred to.

However, measures were ensured to mitigate the environmental impact of the AI system's life cycle. These measures included the minimization of the data set and the utilization of only high-quality data, which contributes to reducing resource consumption and environmental footprint associated with data processing.

9.3.4.7 Accountability

- Auditability

Regarding the establishment of mechanisms that facilitate the system’s auditability, such as ensuring traceability and logging of the AI system’s processes and outcomes, it was noted that the system is indeed auditable, with a logging system in place. While the knowledge system supports auditability, the decision support aspect is not yet fully ready, but efforts are being made to address this issue. Furthermore, in applications affecting fundamental rights, including safety-critical applications, it was ensured that the AI system can be audited independently, thereby enhancing transparency and accountability in the system's operations.

- Minimising and reporting negative Impact

A comprehensive risk or impact assessment of the AI system was conducted, considering the various stakeholders directly or indirectly affected by the technology. Additionally, training and education initiatives were implemented to foster the development of accountability practices within the project. These training sessions involved workers and branches of the team, extending beyond the development phase to ensure a holistic understanding of accountability principles. Moreover, the trainings covered the potential legal framework applicable to the AI system, enhancing the team's knowledge and compliance with relevant regulations and laws.

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- Documenting trade-offs

A mechanism was established to identify the relevant interests and values implicated by the AI system, as well as potential trade-offs between them. The decision-making process regarding these trade-offs involved collaboration with the legal team, ensuring that decisions were made in accordance with legal and ethical considerations. Additionally, efforts were made by the legal team to document the trade-off decisions to maintain transparency and accountability throughout the project.

9.4 STAM SRL

9.4.1 DESCRIPTION OF THE TECHNOLOGY

In both Task 2.6 and Task 4.4, a simulation model that supports various modelling paradigms, including agent-based modelling (ABM), is developed. ABM is particularly relevant for the simulation of complex systems where individual agents interact within an environment. The capabilities of the model developed in AnyLogic allow the creation of realistic digital twins by representing agent behaviour, interactions, and decision-making processes. In addition, Task 4.4 will integrate a user interface that will allow key users to interact with the model.

9.4.2 SUMMARY ELSIA

The implemented technology presents significant potential for positive impacts on the project, particularly in supporting the airport and stakeholders to enhance security, with a likelihood rating of 5 and an intensity rating of 4 (1-2 in the second case). However, there are no identified negative impacts associated with the technology at this time.

In considering potential trade-offs, it's essential to prioritize certain values over others, such as freedom versus security. Reflecting on the responses provided in question one, no significant conflicts have been identified in the project.

The solution proposed involves providing support to the airport and stakeholders to enhance security, particularly in the second case. This is achieved through customization of the data, utilization of generic data, and implementation of a parametric model (e.g., assessing the number of gates). These measures help mitigate the problem by tailoring security measures to specific needs while maintaining a broader applicability. Responsibility for implementing these actions falls to Pietro di Vito (STAM).

9.4.3 SUMMARY DPIA

Personal data that can identify an individual will not be processed. Such data is unnecessary since only the functionality of the process needs to be understood, for which that type of information is not required. Therefore, data from Law Enforcement Agencies (LEAs) will not be processed, nor will assessments, scorings, or profiles be established. Similarly, sensitive data relating to race or ethnicity, political ideology, religion, sexual orientation, etc., will not be processed. A philosophy of minimal data processing will be followed, with all data being anonymized.

Regarding passenger tracking once luggage is tagged, although biometric data may be used, real tracking will not be conducted; instead, an agent with a fake ID will be created. There may arise some security concerns, but with very low probability, which is not entirely likely. In this case, it is due to the

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data necessary for developing the tool at the airport, including data concerning its infrastructure, the sensitivity of which is unknown. To address this issue, anonymization of the relevant airport is planned.

9.4.4 SUMMARY ETHICS OF AI

STAM is not implementing artificial intelligence systems in the BAG-INTEL project.

9.5 INSTITUT NATIONAL DES SCIENCES APPLIQUEES DE ROUEN (INSA)

9.5.1 DESCRIPTION OF THE TECHNOLOGY

INSA (WP4/T4.2) is developing two algorithmic components: an overall risk assessment considering the individual risk indicators and a re-identification risk indicator. The components should be formally specified and tested through a model (prototype) that may be implemented in any programming language. The final specifications of the implementation should be decided once all the modular algorithmic components of the risk-based decision support engine are identified within the WP4.

9.5.2 SUMMARY ELSIA

Technology can have both positive and negative impacts on BAG-INTEL. On one hand, it will enable the optimization of intrusive customs inspections in terms of time and human resources, with a high probability and intensity of impact. On the other hand, there is a high risk of the customs inspection paradigm transition being lengthy, estimated at around 10-15 years.

Potential conflicts in the BAG-INTEL project include the digitalization of the customs inspection process versus the higher exposure to cyber-malevolence actions. To address this, the utilization of constantly evolving advanced data encryption technologies and the development of advanced smart firewalls with systemic backtracking capabilities are envisaged. How solutions will mitigate the problem and the person responsible for it are beyond the technical and scientific competences of the INSA – BAGINTEL Project Team. The application of these solutions is expected to have positive impacts; however, the precise scope of these impacts cannot be accurately assessed at this stage of technology development.

9.5.3 SUMMARY DPIA

9.5.3.1 Principles for proper data processing

INSA will not process personal data that can identify an individual, nor data from LEAs. Additionally, no evaluations or scoring will be conducted. For WPT4.2, no personal data revealing racial or ethnic origin, political opinions, religious or philosophical beliefs, or trade union membership, and the processing of genetic data, biometric data for the purpose of uniquely identifying a natural person, data concerning health or data concerning a natural person's sex life or sexual orientation will be processed. Biometric data will not be used for this purpose either. Finally, a minimal data processing approach will not be followed as the algorithm expected to be developed is designed to use as much data as ethically possible.

9.5.3.2 Actions to Data Protection Principles

The principle of lawfulness, fairness, and transparency of personal data is ensured, as INSA is planned to only use simulated data. The positive impact of this decision will be that the developed algorithm

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can run with the maximum number of ethically available data. INSA will not transfer or store real data. Since INSA will not collect, transfer, or store personal data, the principles of purpose limitation, data minimization, accuracy, storage limitation, integrity and confidentiality, and accountability are all assured. There will be no particular risk associated with data usage, as INSA will not collect, process, cross-reference, or store any personal data. Therefore, no mitigating actions or risk assessments have been deemed necessary in this regard.

9.5.4 SUMMARY ETHICS OF AI

9.5.4.1 Human agency and oversight

The AI system is implemented in the task. Task allocation between the AI system and humans has been considered to ensure meaningful interactions and appropriate human oversight and control, with affirmative responses. Furthermore, the AI system enhances or augments human capabilities. Safeguards have been taken to prevent overconfidence in or overreliance on the AI system for work processes.

The appropriate level of human control for the specific AI system and use case has been considered. The level of human control or involvement has been described, indicating that decisions are made by a human while the system only provides indicators. The "human in control" is a customs official agent, responsible for ensuring all legal guarantees of adequate decision-making and procedural compliance. Mechanisms and measures have been implemented to ensure human control or oversight.

There is no self-learning or autonomous AI system or use case. In principle, no self-learning is to be considered, but this point depends on other packages. The entire process is under human control, with established detection and response mechanisms to assess potential issues. Additionally, procedures are in place to safely abort operations, when necessary, with the entire process being under human control.

9.5.4.2 Technical robustness and safety

- Resilience to attack and security:

Potential forms of attacks to which the AI system could be vulnerable were assessed. Different types and natures of vulnerabilities, including data pollution, physical infrastructure, and cyber-attacks, were considered. While measures or systems to ensure the integrity and resilience of the AI system against potential attacks were not implemented by the project team, it is intended that the system will be secured by the customs offices. The level of risk raised by the AI system in this specific use case was evaluated, and processes were not established independently to measure and assess risks and safety, as the system's security will be managed by the Customs Offices. No risk to human physical integrity was identified. Potential safety risks of foreseeable uses of the technology, including accidental or malicious misuse, were considered, with protection planned by the Customs Offices. Risk analysis included whether security or network problems, such as cybersecurity hazards, could pose safety risks or damage due to unintentional behaviours of the AI system. The likely impact of a failure of the AI system, including providing incorrect results, becoming unavailable, or providing societally unacceptable results, was estimated and addressed.

- Accuracy:

It has been assessed the level and definition of accuracy required in the context of the AI system and use case. Additionally, the project assessed how accuracy is measured and assured. Measures have

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been put in place to ensure that the data used is comprehensive and up to date, as this is one of the objectives of the project.

- Reliability and reproducibility:

A strategy has been implemented to monitor and test if the AI system is meeting the goals, purposes, and intended applications, as this is one of the objectives of the project. Specific contexts or particular conditions have been tested to ensure reproducibility. Verification methods have been established to measure and ensure different aspects of the system's reliability and reproducibility. Processes have been put in place to describe when an AI system fails in certain types of settings, as outlined in the project objectives. These processes for testing and verifying the reliability of AI systems have been clearly documented and operationalized. Mechanisms of communication have been established to assure end-users of the system's reliability.

9.5.4.3 Privacy and data governance

- Respect for privacy and data Protection:

Depending on the use case, mechanisms allowing others to flag issues related to privacy or data protection in the AI system's processes of data collection and processing were not established by the project team. Instead, it is intended that the system will be secured by the Customs Offices. The type and scope of data in the data sets were assessed, including whether they contain personal data. Ways to develop the AI system or train the model without or with minimal use of potentially sensitive or personal data were considered, aligning with one of the objectives of the project. However, measures to enhance privacy, such as encryption, anonymization, and aggregation, were not implemented by the project team, as the system's security will be managed by the Customs Offices. In cases where a Data Privacy Officer (DPO) exists, this person was involved at an early stage in the process, with development including the Customs Offices.

- Quality and integrity of data:

Oversight mechanisms for data collection, storage, processing, and use were not established by the project team. However, processes were implemented to ensure the quality and integrity of the data. The verification of data sets to ensure they have not been compromised or hacked was also undertaken.

- Access to data:

An assessment was conducted to determine who can access users' data and under what circumstances. Measures were implemented to ensure that these individuals are qualified and required to access the data, and that they possess the necessary competences to understand the details of the data protection policy. Additionally, an oversight mechanism was established to log when, where, how, by whom, and for what purpose data was accessed, in alignment with one of the objectives of the project.

9.5.4.4 Transparency

- Traceability:

Measures were established to ensure traceability.

- Explainability:

The project assessed: the extent to which decisions and outcomes made by the AI system can be understood, the degree to which the system's decisions influence the organization's decision-making processes and why this particular system was deployed in this specific area.

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Additionally, measures were taken to ensure an explanation as to why the system took a certain choice resulting in a certain outcome that all users can understand. Efforts were made to use the simplest and most interpretable model possible for the application in question. The project assessed the ability to analyse training and testing data, as well as the possibility to change and update this data over time. Furthermore, considerations were made regarding the ability to examine interpretability after the model's training and development, and whether there is access to the internal workflow of the model.

- Communication:

Clear and intelligible communication to the intended audience was one of the objectives of the project, and efforts were made to fulfil this objective. Processes were established to consider users' feedback and adapt the system accordingly, aligning with another objective of the project. Communication and transparency towards other audiences, third parties, or the general public were not handled independently by the project team but depended on the Customs Offices. However, characteristics, limitations, and potential shortcomings of the AI system were clearly communicated. This communication extended to whoever deployed the system into a product or service during development, as well as to the end-users or consumers upon deployment.

9.5.4.5 Diversity, non-discrimination and fairness

- Unfair bias avoidance:

A strategy or set of procedures was established to avoid creating or reinforcing unfair bias in the AI system, both regarding the use of input data and algorithm design. The project assessed and acknowledged possible limitations stemming from the composition of the used data sets. Diversity and representativeness of users in the data were considered, and testing was conducted for specific populations or problematic use cases. Available technical tools were researched and utilized to improve understanding of the data, model, and performance. Processes were implemented to test and monitor for potential biases during the development, deployment, and use phases of the system.

It was assessed whether there is any possible decision variability that can occur under the same conditions. If so, the possible causes of this were considered. However, it was determined that no variability will be possible. Additionally, in case of variability, a measurement or assessment mechanism of the potential impact of such variability on fundamental rights was established.

- Accessibility and universal design:

The AI system was partially ensured to accommodate a wide range of individual preferences and abilities. However, it was assessed that the system may not be usable by those with special needs or disabilities, or those at risk of exclusion, as the indicators are graphical and do not consider blind individuals. Nevertheless, efforts were made to ensure that information about the AI system is accessible to users of assistive technologies. However, the community of individuals with special needs or disabilities was not involved or consulted during the development phase of the AI system.

The impact of the AI system on the potential user audience was considered, with the project objective being to reduce such an impact. The team involved in building the AI system was assessed for its representation of the target user audience and the wider population, considering other groups who might tangentially be impacted. Additionally, an assessment was conducted to identify persons or groups who might be disproportionately affected by negative implications. However, feedback from other teams or groups representing different backgrounds and experiences was not obtained.

- Stakeholder participation:

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A mechanism to include the participation of different stakeholders in the AI system's development and use was considered.

9.5.4.6 Societal and environmental well-being

Mechanisms to measure the environmental impact of the AI system's development, deployment, and use, such as the type of energy used by the data centers, were not established. Additionally, measures to reduce the environmental impact of the AI system's life cycle were not ensured.

9.5.4.7 Accountability

- Auditability:

Mechanisms were established to facilitate the system's auditability, including ensuring traceability and logging of the AI system's processes and outcomes. Additionally, in applications affecting fundamental rights, including safety-critical applications, measures were taken to ensure that the AI system can be audited independently.

- Minimising and reporting negative Impact:

A risk or impact assessment of the AI system was carried out as one of the objectives of the project, considering different stakeholders that are directly or indirectly affected. Additionally, training and education were provided to help develop accountability practices, aligning with another objective of the project. Customs agents were involved in this training, extending beyond the development phase. However, these trainings did not include teaching the potential legal framework applicable to the AI system.

- Documenting trade-offs:

A mechanism was established to identify relevant interests and values implicated by the AI system and potential trade-offs between them, in alignment with one of the objectives of the project. Decisions on such trade-offs were made, and efforts were made to ensure that the trade-off decisions were documented, as part of another objective of the project.

9.6 SMITHS DETECTION GERMANY GMBH (SDE)

9.6.1 DESCRIPTION OF THE TECHNOLOGY

Detection of contraband objects in X-ray images of passenger bags. The algorithm uses conventional image processing with the final decision step learned from intentionally generated image data. This learning step is considered as the algorithm's AI part. During inference phase, the algorithm runs on X-ray images, no link to personal data.

9.6.2 SUMMARY ELSIA

Regarding the impacts that the technology may have on BAG-INTEL, various facets have been identified. Firstly, there is the risk assessment for 100% of passenger bags to detect contraband. The likelihood of this occurrence is rated at 5, indicating a high probability, while the intensity, representing the severity of the impact, is assessed at 4. Additionally, the technology introduces the capability to identify contraband items previously undetectable by humans. This advancement is assigned a likelihood rating of 3, indicating a moderate probability, and an intensity rating of 3, suggesting a moderate level of impact. This represents a notable improvement in security measures but with a

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moderate level of associated risk. Furthermore, there is an additional burden placed on customs officers due to bags triggering alarms, including false alarms. This scenario is rated with a likelihood of 5, indicating a high probability, and an intensity of 3, reflecting a moderate level of impact. While the likelihood of occurrence is high, the intensity of the impact is somewhat mitigated, although it still presents a significant challenge for customs officers.

Several conflicts arise in the project. Firstly, there is a conflict between detection probability and false alarms, which directly relates to the burden of unnecessary bag checks. To address this, two potential solutions have been proposed: first, to decrease false alarms even if it means lowering the detection probability, and second, to intentionally exclude certain bags from assessment, deviating from the 100% evaluation approach. Secondly, there exists a conflict between the scope of contraband detection and false alarms, which again impacts the burden of unnecessary bag checks. To mitigate this conflict, two solutions have been identified: firstly, to decrease false alarms even if it impacts the detection probability, and secondly, to reduce the number of contraband categories being considered, thereby streamlining the detection process and potentially reducing false alarms.

Considering the proposed solutions, each contributes to mitigating the identified problems in distinct ways. Firstly, Solution 1, involving a lower detection probability, aims to reduce the number of bag checks, consequently minimizing the burden on customs officers. However, this approach comes with the trade-off of potentially higher risks associated with undetected contraband. The responsibility for implementing this action falls upon the SDE and end users. Secondly, Solution 2 suggests intentionally leaving out certain bags from assessment, leading to fewer bag checks and a subsequent reduction in the burden on customs officers. Similarly to Solution 1, this approach poses a higher risk of undetected contraband. The responsibility for implementing this action lies with the Task 4 partners. Lastly, Solution 3 proposes reducing the number of contraband categories considered during assessment. This approach aims to streamline the detection process, resulting in fewer bag checks while acknowledging the limitations of the chosen categories. Like Solution 1, the responsibility for implementing this action rests with the SDE and end users.

After implementing the proposed solutions, the risk assessment for the presence of contraband in 100% of passenger bags remains a high-risk factor, with a likelihood rating of 5 and an intensity rating of 4. Similarly, the ability to identify contraband items previously undetectable by humans maintains a moderate level of risk, with a likelihood rating of 3 and an intensity rating of 3. Lastly, the additional burden on customs officers due to alarmed bags, including false alarms, remains a significant challenge, with a likelihood rating of 5 and an intensity rating of 3.

9.6.3 SUMMARY DPIA

Not applicable because the implementation of this technology does not deal with personal data.

9.6.4 SUMMARY ETHICS OF AI

9.6.4.1 Human agency and oversight

The AI system has been implemented in the task. Task allocation between the AI system and humans was carefully considered to ensure meaningful interactions and appropriate human oversight and control. Moreover, the AI system is designed to enhance and augment human capabilities, rather than replace them entirely. Safeguards have been implemented to prevent overconfidence in or overreliance on the AI system for work processes, ensuring a balanced and responsible approach to its utilization.

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The appropriate level of human control for the AI system and use case was not directly applicable, as the algorithm provides a risk assessment for each passenger bag, but actual checking is conducted by humans. In this setup, customs officers serve as the "humans in control," responsible for checking bags in the customs area based on the risk assessment provided by the AI system. Mechanisms and measures have been implemented to ensure human control and oversight, with the AI operating strictly as a support or assist system, adhering to established principles.

The AI system does not incorporate self-learning or autonomous capabilities. Therefore, specific mechanisms of control and oversight for such functions were not implemented. As there is no autonomous learning, detection and response mechanisms were not established to assess potential issues. Additionally, since there is no autonomous learning, the need for a stop button or procedure to abort an operation does not apply, as the system does not engage in autonomous decision-making that would necessitate such intervention.

9.6.4.2 Technical robustness and safety

- Resilience to attack and security:

Potential forms of attacks to which the AI system could be vulnerable were assessed. This assessment included consideration of various types and natures of vulnerabilities, such as data pollution, physical infrastructure vulnerabilities, and cyber-attacks.

Measures and systems were implemented to ensure the integrity and resilience of the AI system against potential attacks.

The level of risk raised by the AI system in this specific use case was considered, drawing from similar existing use cases such as explosives screening for outbound luggage. While no specific process was put in place to measure and assess risks and safety, potential safety risks of foreseeable uses of the technology, including accidental or malicious misuse, were identified, and plans to mitigate or manage these risks were developed. Additionally, the risk analysis included considerations of whether security or network problems, such as cybersecurity hazards, could pose safety risks or damage due to unintentional behaviour of the AI system.

The likely impact of a failure of the AI system, including scenarios where it provides wrong results, becomes unavailable, or produces societally unacceptable results such as discrimination, was estimated.

- Accuracy:

The level and definition of accuracy required in the context of the AI system and its use case were assessed. Additionally, measures were put in place to ensure that the accuracy of the system is measured and assured, and that the data used is comprehensive and up to date.

- Reliability and reproducibility:

A strategy was implemented to monitor and test if the AI system is meeting its goals, purposes, and intended applications. Specific contexts and conditions were tested to ensure reproducibility, and verification methods were established to measure and ensure different aspects of the system's reliability and reproducibility. While processes were not specifically put in place to describe when the AI system fails in certain types of settings, mechanisms of communication were established to assure end-users of the system’s reliability.

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9.6.4.3 Privacy and data governance

- Respect for privacy and data Protection:

The project assessed the type and scope of data in the datasets, confirming that they solely consist of X-ray images of bags without any connection to personal data. Measures were taken to develop the AI system or train the model without or with minimal use of potentially sensitive or personal data. However, specific measures to enhance privacy, such as encryption, anonymization, and aggregation, were not deemed necessary due to the nature of the data. Additionally, involvement of a Data Privacy Officer (DPO) was not applicable in this context.

- Quality and integrity of data:

Oversight mechanisms were established for data collection, storage, processing, and use. Processes were implemented to ensure the quality and integrity of the data. Additionally, measures were taken to prevent data compromise or hacking by conducting training exclusively offline, with no autonomous learning in the field. Training data is securely stored on premises with strict access control measures in place to safeguard its integrity.

- Access to data:

Since no users' data is involved, protocols, processes, and procedures for managing data governance were not applicable. Therefore, assessments regarding who can access users' data, their qualifications, and oversight mechanisms for logging data access were not conducted.

9.6.4.4 Transparency

- Traceability:

Partly, measures were established to ensure traceability within the project's scope.

- Explainability:

The extent to which the decisions and outcomes made by the AI system can be understood was assessed. Additionally, an evaluation was conducted regarding why this particular system was deployed in this specific area. An explanation as to why the system took a certain choice resulting in a certain outcome that all users can understand was not ensured.

The AI system was not designed with interpretability in mind from the start. However, efforts were made to research and use the simplest and most interpretable model possible for the application in question. Additionally, an assessment was conducted to determine the feasibility of analysing training and testing data, as well as the ability to change and update this over time. Furthermore, an examination was undertaken to assess interpretability after the model's training and development, as well as access to the internal workflow of the model.

- Communication:

Mechanisms were established to inform end-users about the reasons and criteria behind the AI system's outcomes, partially through information about training and verification data. This information was communicated clearly and intelligibly to the intended audience. Additionally, processes were put in place to consider users' feedback and adapt the system accordingly. However, communication and transparency towards other audiences, third parties, or the general public were not considered, as it was deemed not applicable to the use case.

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Characteristics, limitations, and potential shortcomings of the AI system were clearly communicated. During the system's development, this information was conveyed to whoever was deploying it into a product or service. Similarly, upon the system's deployment, the same information was communicated to the end-user or consumer, ensuring transparency and understanding of the system's capabilities and constraints.

9.6.4.5 Diversity, non-discrimination and fairness

- Unfair bias avoidance:

No specific strategy or set of procedures were established to avoid creating or reinforcing unfair bias in the AI system, as it was deemed not applicable in this context.

The assessment confirmed that there is no possible decision variability under the same conditions, as the algorithm is deterministic. Therefore, no consideration was given to possible causes of variability or the establishment of a measurement or assessment mechanism of the potential impact of such variability on fundamental rights.

- Accessibility and universal design:

The accommodation of a wide range of individual preferences and abilities was not applicable in the development of the AI system, as it was not designed to cater to specific needs or disabilities. Consequently, considerations regarding usability for those with special needs or disabilities, accessibility for users of assistive technologies, and consultation with relevant communities were not included in the development phase.

The impact of the AI system on the potential user audience was taken into account during the development process. The team involved in building the AI system was assessed for its representativeness of the target user audience and the wider population, considering other groups that might be tangentially impacted. Feedback from teams or groups representing different backgrounds and experiences was obtained to ensure a comprehensive understanding of potential implications. However, there was no specific assessment conducted to identify persons or groups who might be disproportionately affected by negative implications.

- Stakeholder participation:

A mechanism was considered to include the participation of various stakeholders in both the development and use of the AI system.

9.6.4.6 Societal and environmental well-being

Mechanisms were established to measure the environmental impact of the AI system's development, deployment, and use, such as monitoring the type of energy used by data centres. However, specific measures to reduce the environmental impact of the AI system's life cycle were not implemented.

9.6.4.7 Accountability

- Auditability:

While mechanisms were partly established to facilitate the system's auditability, such as ensuring traceability and logging of the AI system's processes and outcomes, measures to ensure independent auditability were not applicable, particularly in applications affecting fundamental rights or safety-critical applications.

- Minimising and reporting negative Impact:

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While no risk or impact assessment of the AI system, considering different stakeholders directly or indirectly affected, was conducted, there were training and educational initiatives aimed at developing accountability practices. These efforts primarily involved legal and ethical training on the company level, extending beyond the development phase. However, these trainings only partly covered the potential legal framework applicable to the AI system.

- Documenting trade-offs:

While no mechanism was established to identify relevant interests and values implicated by the AI system and potential trade-offs between them, decisions on such trade-offs were not made, and therefore, no documentation of trade-off decisions was necessary.

9.7 EXUS SOFTWARE MONOPROSOPI ETAIRIA PERIORISMENIS EVTHINIS (EXUS)

9.7.1 DESCRIPTION OF THE TECHNOLOGY

EXUS is participating in the Task 4.5 "Machine learning for ongoing improvement of the decision making" which is led by UGR. In the context of this task EXUS is going to use machine learning techniques that aim to improve decision making of LEAs and more specifically customs authorities. The solution will extract intelligence having as input risk levels coming from Task 4.2. In addition, from the designing phase until the implementation and demonstration the solution will follow a "human in the loop" approach. The final output will be recommendations for physical inspection of the baggage.

9.7.2 SUMMARY ELSIA

We envisage the solution to have a positive impact (very high likelihood, very high intensity), given that will have been taken care all the security and data protection measures according to the GDPR. The solution is considered as a non-intrusive, it will assist the automation and it will enhance the decision making, thus we expect to have a huge impact on the customs process and daily life, without jeopardizing citizens flow and their personal data.

On the other hand, a potential negative impact, we could consider at this stage, is the ratio of false alarms of the decision support tool. Given that this is known and it has been identified from the very beginning of the project from all technical partners, we are expecting the likelihood to be very low. However, if this may happen then the intensity could be medium or high. EXUS is going to take all the needed measures in order to mitigate this risk by:

1. **Fine-tuning Algorithms:** Refine and optimize the machine learning algorithms used in the decision support tool to minimize false alarms. This can involve adjusting parameters, updating models with new data, and implementing more sophisticated algorithms.
2. **Threshold Adjustment:** Set appropriate thresholds for triggering alarms based on the risk tolerance of the system and the consequences of false positives. By carefully calibrating these thresholds, the system can strike a balance between sensitivity and specificity.
3. **Human Oversight:** Incorporate human oversight and review into the decision-making process to validate alarm triggers and reduce the likelihood of false alarms. This can involve customs officers or trained personnel manually verify suspicious findings before taking action.

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In general, we expect the solution to have a positive impact. The consortium is paying attention and is putting a lot of effort in the designing phase, engaging all the relevant stakeholders and the end users in these tasks, in order to mitigate potential risks (Ethical and technical).

9.7.3 SUMMARY DPIA

EXUS does not intend to process personal data for identification purposes. Instead, the focus is on processing risk levels. Furthermore, there are no plans to handle Law Enforcement Agencies' data, such as ID numbers, criminal records, or terrorist labelling.

Evaluation or scoring activities, including profiling and prediction based on various personal aspects, are not applicable within the scope of EXUS. Similarly, there are no plans to use automated decision-making processes with legal implications.

EXUS explicitly states its avoidance of processing sensitive data categories, such as racial or ethnic origin, political opinions, religious beliefs, genetic data, biometric data for identification, health information, or data concerning a person's sex life or sexual orientation. Its sole focus remains on processing risk levels.

Regarding passenger tracking procedures, EXUS does not intend to utilize biometric data such as fingerprints or facial recognition. Instead, it emphasizes the commitment to processing the minimum necessary data for the task. This underscores the dedication to privacy and data minimization principles, aiming to utilize only essential data required for the development of a robust AI solution.

9.7.4 SUMMARY ETHICS OF AI

9.7.4.1 Human agency and oversight

The AI solution is going to be implemented in T4.5 “Machine learning for ongoing improvement of the decision making”. The task is designed to include human in the loop, thus, to ensure meaningful interactions and appropriate human oversight and control. The AI solution is envisaged to assist in the decision-making process and not to provide decisions. The system's outputs will be designed to provide insights rather than directives, emphasising the tool's role as a support mechanism rather than a decision-maker. This approach mitigates the risk of output manipulation by ensuring that final actions remain within the human users' purview, thus maintaining and emphasising human critical decision-making role. In addition, the solution will provide the level of accuracy and will explore the ability to incorporate explainability, ensuring that it provides a sufficient level of transparency to avoid overconfidence and/or overreliance.

The level of human control or involvement is significant. The “Human in control” are the LEAs and especially the custom authorities, which are going to have access to the system and its outputs. Moreover, following a co-creation, co-implementation approach, allows experts and end users to provide data, adjust parameters and interpret outcomes within their operational context. Mechanisms are going to be in place in order to ensure human control and /or oversight. User oversight is facilitated by a comprehensive feedback mechanism and regular system update. These practices enable continuous monitoring of the solution performance and the integrity of its algorithms, ensuring that the system remains aligned with ethical standards and operational requirements. Even if the nature of the system is to produce recommendations the final decision and the ultimate control is on human hands.

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9.7.4.2 Technical robustness and safety

- Resilience to attack and security:

EXUS is taking significant consideration against technical robustness and the resilience of the system. Thus, vulnerabilities like data pollution and cyber-attacks have been considered and appropriate techniques of data security and access control will be applied. Given that the final decision is on human, potential vulnerabilities and system failures are reduced significantly, as human expertise provides an additional layer of assurance and safeguards the final outcome.

- Accuracy:

It is well known that accuracy in AI systems is one of the most critical factors for the reliability of the results. However, it is needed to be mentioned that we are in the early stages of the project and a specific metric for accuracy has not been yet established. However, it is already considered and towards this direction in order to measure and assure accuracy, various techniques will be employed, including cross-validation, performance metrics (e.g., precision, recall, F1-score), and will be validated against ground truth or expert judgment. It's essential to establish robust validation procedures to assess the model's performance under different conditions and ensure that it generalizes well to unseen data.

Furthermore, measures will be put in place to ensure that the data used is comprehensive, representative of real-world scenarios, and up to date. This includes data preprocessing techniques to handle missing values, outliers, and abnormal values.

- Reliability and reproducibility:

A mechanism will be in place in order to monitor and test AI outputs and if these are fulfilling its purpose. A comprehensive feedback mechanism and regular system update will be in place.

This includes conducting thorough testing, validation, and verification activities throughout the development lifecycle to identify and rectify any errors or inconsistencies in the system.

Moreover, we will implement error handling mechanisms to gracefully handle unexpected situations or failures in the AI system. This includes strategies for detecting errors, logging diagnostic information, and implementing fallback mechanisms to maintain system functionality in case of disruptions.

9.7.4.3 Privacy and data governance

In the context of T4.5 is essential to safeguard personal information while at the same time maintain data integrity and relevance for customs operations. Towards this direction the implementation of the decision support tool will be based on experts' knowledge and research community, in order to ensure that system's foundations are built on a privacy-conscious framework, avoiding direct interaction with raw data that may contain sensitive personal information. However, at this point it is needed to be mentioned that decision support tool will consume risk levels coming from Task 4.2 which are not considered as sensitive data.

9.7.4.4 Transparency

One of the strongest points of the solution is the establishment of a feedback loop providing direct information of the results of the system. This feedback not only informs ongoing refinements to the system but also fosters an open dialogue between the development team and the users, promoting a culture of transparency and continuous learning. On top of that the development team is committed to provide regular updates of the system performance, ensuring that the end users are well informed about the system's evolution reinforcing transparency. Training sessions and pilot demonstrations will further enhance communication and transparency via the detailed documentation and actionable system results.

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9.7.4.5 Diversity, non-discrimination and fairness

Given that we do not expect to process personal data, diversity, non-discrimination and fairness are not applicable for the solution.

9.7.4.6 Societal and environmental well-being

By equipping customs authorities with a solution that enhance their decision-making process not only improves the fight against crime and its side effects in our communities, but also empowers law enforcement personnel by automating analytical tasks. This automation and analysis assist officers in their daily workload and increase their performance, elevating at the same time their professional capabilities. By providing customs authorities with advanced analytics, the tool can help in detecting and preventing illicit trafficking of goods, including hazardous materials and counterfeit products. This contributes by maintaining public safety and protecting the environment from harmful substances. Decision support tool and all Bag-INTEL solutions stand as a testament to our dedication to advancing societal and environmental wellbeing, ensuring that the benefits of technology in public safety are realised in a manner that is both ethical and sustainable.

9.7.4.7 Accountability

Fulfilling accountability is an essential aspect of our work, ensuring that every step of developing and deploying the decision-making tool will be conducted with a sense of responsibility and oversight. The solution will be implemented in a way that ensures auditability, transparency, and continuous engagement of the stakeholders. According to project processes the solution will be documented providing a comprehensive audit trail from design to deployment, enabling both internal reviews and external audits to assess the system's adherence to ethical standards and operational requirements. As it is already stated, regular updates and open communication channels ensure that stakeholders are informed about the system's progress, changes, and the rationale behind key decisions, fostering an environment of transparency. On top of that decision making process involves legal-ethical project team in order to ensure that the decisions were made in accordance with legal and ethical considerations. By embedding such practices, it is ensured that the solution is robust enough for the customs and in parallel assure our commitment to accountability, reflecting our dedication to ethical AI development and deployment.

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10 CONCLUSIONS CHAPTER II

The completion of the questionnaires has been positive because, in these first phases, it has served to detect points that the partners did not have in mind, to educate the engineers in risk prevention and for a first analysis of the risks associated with the data and the use of artificial intelligence tools.

The questionnaires have been adapted to the objectives and context of the project. Even so, some partners have had problems in understanding certain issues and so videoconferences have been held to address these doubts and to conduct the process of collecting information from the partners.

The result has been very positive in terms of understanding the technological development of the project as a whole and detecting any problems that may arise.

In addition, it has served to specify the data to be used in the project before starting to collect them. This has made it possible to limit the amount of data used and to take the necessary security and privacy measures to use them in an appropriate manner. Thus, it has been decided not to use real data but to use categories of data and to use either anonymized or synthesized data.

The next step is to analyse and resolve legal and ethical issues that partners may have in the development of the project in a more personalized way.

In addition, another round of questionnaires will be conducted with the technical part of the project to check that the agreed measures have been implemented and to examine whether changes need to be implemented to achieve compliance with the ethical principles.

When the LEAs come into play and before conducting the pilots, risk questionnaires will be carried out with the non-technological partners to carry out the ethical and legal evaluation in order to meet the project objectives in an ethical and legal manner, instruct the LEAs in the correct use of the technology and mitigate the risks that may be observed in a scenario close to the real one.

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