D7.10: FINAL VERSION OF STANDARDIZATION AND CONCERTATION ACTIVITIES REPORT

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Work Package WP7 - Exploitation and dissemination plan including standardization activities

Abstract

This report is the final output of task 7.3 "Standardization and Concertation Activities" and provides the perspective of the project in relation to the standardization.

It reports the standardization and concertation activities during the second half of the project.

The report describes the actions taken by the CPSoSaware partnership to perform an evaluation of the standardization needs for the CPSoSaware solution at its current states of technologies readiness level.

It furthermore describes the considerations related to standards and actions taken to disseminate the technological content of the project toward standardization stakeholders when considered relevant.

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Control Sheet

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Executive summary

The purpose of this document is to report on the standardization activities that have been undertaken during the lifetime of the CPSoSaware project, specifically addressed by Task T7.3 “Standardization and Concertation Activities”. To that end, the main objectives of Deliverable D7.10 “Final Version of Standardization and Concertation Activities Report” are to outline the existing standards and guidelines relevant to CPSoSaware in order to conform the project development to up-to-date norms and guidelines and ensure a high-quality outcome with an increased exploitation potential.

CPSoSaware project has been analyzing the standardization landscape related to its development all through the duration of the project. This deliverable lists the main actions toward standardization needs and requirements related to dissemination; External dissemination toward standardization stakeholders; specific actions such as, for example, standardization approaches with the CIAG external experts meeting and the application to the European Standardization Booster “HS booster”.

D7.10 Final Version of Standardization and Concertation Activities Report documents the final summary of the project’s standardization activities.

1 Introduction

This deliverable is the output of task 7.3 “Standardization and Concertation Activities” and presents the perspective of the project in relation to standardization. This document is the final version of deliverable 7.5 “Preliminary Version of Standardization and Concertation Activities Report” issued in month 18.

The CPSoSaware project is developing several technological systems and a dedicated approach for the reliable integration of these systems into a complete, robust, and secure system of systems. The expected output TRL related to the developed technologies from the project is relatively low and reaches TRL5 (validation in a relevant environment.

On the other end all the developed technologies (SW, HW, active modules, algorithms…) converge in full systems of systems in the two pilots of the project:

- Automotive application in Systems for the improvement of ADAS systems in connected and autonomous L3-L4 vehicles
- Manufacturing Safe applications of Human Robot Collaboration in an automotive production plant ensuring operational continuity.

While the developed technologies are at low TRLs, the application layer is at high TRL and refers to applications that could be commercial or near to commercialization.

This difference clearly and evidently generates a gap in terms of standardization needs between technologies that need to develop and prove functionality and use-cases that require full functionalities and commercial applicability, also considering standardization requirements.

In the rest of the document, the results from the analysis of the standardization needs of the consortium will be analyzed and considered, and the actions that the consortium underwent in order to keep standardization needs and requirements at a proper level in the consortium development will be listed.

This document lists the actions taken in the second period of Task 7.3 (Standardization and Concertation Activities) from month 19 to month 36. The activities from the task had a threefold purpose:

1) Monitoring the existing standardization landscape by keeping a trace of updates in the standard related to the project.
   Creating in the partnership an increased sensitivity and know-how toward the needs and use of the standards in the development activities.
2) Organizing the approach, followed by the project to communicate CPSoSaware technologies and methodologies toward standardization-related stakeholders. These stakeholders have been identified as:
   a) Experts from the CIAG group with activities related to standardization developments and possibly participating in standardization bodies:
   b) Other European projects developing contents on similar topics
   c) Experts of standardization bodies

European commission

As for point one, CPSoSaware compiled and monitored the content of the shared XLS running documents compiled by the partnership. The updates on the relevant standards were coming from the partners themselves and were shared as a common utility for the partnership. Furthermore, in the file the existing contacts with technical groups

and standardization bodies by one or more partners, were listed and made available to other partners in case required or desired.

Other important points in the shared file were the list of needs/risks emerging from interaction with the existing standardization landscape (no risk emerged from the continuous monitoring) and the list of actions taken toward standardization bodies or standard oriented authorities and stakeholders in order to keep a trace of undertaken actions.

Besides the partnership's actions monitoring, the project decided to take advantage of the Commercial Interest Advisory Group (CIAG) meeting, organized by ROBOTEC with CRF and 8bells support, by involving in the group of advisors, experts coming from, or at least actively participating to, the standardization relevant landscape. During the CIAG Meeting a selected set of questions related to standardization needs/opportunities were set to experts for each exploitable result. The project decided to focus on standardization aspects of the exploitable results, being the nearest to commercialization, and thus the most exposed to potential standard development needs.

Other minor initiatives were undertaken (listed in the deliverable). In parallel with all the standardization activities promoted, the path for the Horizon Standardization Booster (HS Booster) was also activated for the CPSoSaware project. The HS booster is a service promoted under the patronage of the European Commission aiming at supporting EU research and innovation projects to exploit the results through standardization and addressing the urgencies identified in the EU standardization strategy. As stated below the process was initiated, but not completed at the date of the end of the project.

The partnership agreed to continue and try to complete the relevant process and provide a dedicated update to target partners in case comments, suggestions, or requests from the HS booster arise.

1.1 Document structure

This document is structured into four main sections:

- Section 1 introduces the document, outlining its structure, and identifying terms and acronyms used across the document.
- Section 2 provides a description of the methodology applied for the collection and classification of the standards involved during the two Use Cases, the current reference standards to be considered in these applications, and the plan of the standardization activities implemented directly and indirectly affected by the project.
- Section 3 identifies the channels used for the dissemination activities, the standardization approach used with the CIAG members, the criteria implemented and used for the organization of CIAG meeting with a focus related to the questionnaire sent them and the submitted of CPSoSaware application for HS Booster.

1.2 Acronyms and descriptions

Below are listed the most relevant acronyms used in the document and recurring definitions:

Acronym / Term	Description
3GPP	3rd Generation Partnership Project
ADAS	Advanced driver-assistance system
CEN	European Committee for Standardization
CIAG	Commercial Interest Advisory Group
C-V2X	Cellular V2X
DSM	Driver State Monitoring
DSRC	Dedicated short-range communications
GDPR	General Data Protection Regulation
HRC	Human Robot Collaboration
HS Booster	Horizon Standardization Booster
HW	Hardware
IEC	International Electrotechnical Commission
ISO	International Organization for Standardization
OSM	Operator State Monitoring
PoCL-R	Portable Computing Language Runtime
SRMM	Security Runtime Monitoring and Management
SW	Software
TBT	Technical Barrier Treatment
TC	Technical committee
UNI	Italian National Unification Body
UNE	Asociación Española de Normalización
V2X	Vehicle-to-everything
WD	Working Draft

2 Methodological collection of Standardization & Concertation Activities

2.1 CPSoSaware standardization approach

As described in the "D7.5: preliminary version of standardization and concertation activities" report, the project has collected preliminary information from the partners through a tool (shared XLS file) described in the context of D7.5 itself. Through the above XLS file, the partnership collected and recorded actions and connections with the standardization landscape.

The objective of the document is to collect all the main regulations/laws/standards concerning the reference Use Cases and define the standardization landscape for the CPSoSaware project. The file (a shared XLS running document) was compiled and monitored by the partnership.

As described in D7.5, the spreadsheet file is mainly composed by 4 reference tabs:

1. Current Reference standards.
2. CPSoSaware content.
3. Standardization bodies contact.
4. Standardization Activities Plan

In the first sheet (Current Reference standards), the main rules/regulations/standards/laws that are considered relevant for the Use Cases have been collected. The list of related standards collected is made of 80 relevant standards (listed in Annex 1) mainly related to high-level TRL applications in the end-user field. The complete list of identified standards is reported in paragraph "6.1 Annex 1 - Current Reference standards".

Compared to the situation presented in deliverable 7.5, the references have been updated with the inclusion of two new documents: IEEE 802.11p - DSRC and 3GPP C-V2X; both related to the Automotive Use case.

Document identifier	Title	Abstract	Committee reference	Publication date	Legal connection / value	Category	Use Case	Relation to CPSoSAware	How does the standard have an impact on CPSoSAware contents?
IEEE 802.11p - DSRC	A part of to the IEEE 802.11 standard related to wireless access in vehicular environments (WAVE), a vehicular communication system.	Dedicated Short Range Communication (DSRC) was introduced in the IEEE 802.11p, a variant of the original WiFi standard. The 75MHz band of 6GHz spectrum (5.85 to 5.925 GHz) was allocated to DSRC-capable devices	IEEE The Institute of Electrical and Electronics Engineers	15/07/2010	Yes : V2X Simulation	Communication	Automotive		Affects the V2X Simulation module
3GPP C-V2X	The 3rd Generation Partnership Project (3GPP) is an umbrella term for a number of standards organizations which develop protocols for mobile telecommunications. The part mentioned in this document is related to Cellular Vehicle-to-everything networks	Cellular V2X (C-V2X) is a 3GPP standard for V2X applications such as self-driving cars and ADAS systems. It is an alternative to 802.11p, the IEEE specified standard for V2V and other forms of V2X communications.	The 3rd Generation Partnership Project (3GPP)	2014-2017	Yes : V2X Simulation	Communication	Automotive		Affects the V2X Simulation module

Figure 1: - Extract of the table relative to Current Reference Standards

The initial list of standards, as well as the updates on the relevant standards, were coming from the partners themselves and were shared as a common utility for the partnership. Furthermore, in the file the existing contacts with technical groups and standardization bodies by one or more partners, were listed and made available to other partners in case required or desired.

As for sheet 2 (**CPSoSaware content**), the CPSoSaware consortium is not identifying relevant risks by the standardization landscape that can hinder the application of the developments. The data in sheet n° 2 are reported in the following table: other considerations on the relevance of standards in relation to developments are reported in paragraph 2.2.

Table 1: Project's content in relation to standards.

CPS content	Demonstrator	Description	Innovative contents with standardization relevance	Possibly affected standards	Standardization bodies	Technical committee
Active anthropometric adaptation of machinery	Manufacturing Use-Case	Skeleton dynamic recognition for anthropometric adaptation of machinery	Active adjustment of machinery is not standardized; risk assessment definition for all situations and body percentiles	10218-1;10218-2; TS 15066	ISO	299
Driver State Monitoring (DSM) and Operator State Monitoring	ADAS /Manufacturing use-cases	Monitoring of driver's state using mobile device and wearable sensors	DSM is not standardized; risk assessment definition for all state scenarios	MPEG-7	ISO	
Semantic data integration framework	ADAS use-case	Semantically integrates data from various sources (e.g., sensors, components performing analyses, etc.) into a uniform semantic model and runs rules on-top that derive inferences.	Semantic data integration process based on CTL's novel CASPAR framework.	R2RML	W3C	
4D Co-operative situational Awareness	Automotive Use Case	Design and development of multimodal cooperative	Co-operative awareness functions have not been standardized as the Sensing and the communication functions	ISO TC204, NHTSA	ISO, NHTSA	ISO TC22

		approaches for 4D Situational Awareness	are tackled in different standards			
AR application in Manufacturing application	Manufacturing use-case	Augmented reality application for training on the job in robotic collaborative applications	The HoloLens is Certified and has the CE mark and incorporation declaration. The device is not Safe according to ISO 13849-1 and cannot thus be used for Safety related. The use done is studied not to require functions that could be affected by Safety or special standard development request.	-	-	-

As for the existing contacts (in terms of direct participation of partners to standardization bodies or technical committees (Sheet 3 - Std. bodies contact), the partners CRF, PASEU, and Catalink are participants in some of the relevant standardization bodies.

Table 2: CPSoSaware contact with standardization bodies and technical committees.

Partner	Std Body	Committee
CRF	UNI/ISO	ISO 10218 renewal (ISO 20218) TC199
PASEU	IEEE Standards	IEEE P2020 Standards
PASEU	ADASIS	ADASIS Protocol V3
CTL	ISO	MPEG-7 renewal
CTL	W3C	R2RML

The listed presence guarantees, from the partnership point of view the possibility to disseminate its developed content in the relevant environment and the necessary know-how in relation to standardization.

The presence of three partners in standardization bodies allowed some specific actions toward the technical committee to be taken, such as dedicated papers on topics known to be relevant or the possibility to invite in the CIAG meeting experts participating in Standardization workgroups.

The fourth sheet (Standardization plan) is a collection of the actions directly taken by the partnership toward the dissemination of its contents. These actions are detailed in chapter 3.

2.2 CPSoSaware exploitable results – relation to standardization

In the following, an analysis of each of the exploitable results produced by the CPSoSaware project has analysed and commented on in term of its relation to ISO standardization. This is made to show and highlight how the standardization landscape was taken into consideration by the partnership in the reference development actions.

2.2.1 ATOS - Security Runtime Monitoring and Management

ATOS results regarding the SRMM have no content directly related to standardization. No specific standardization has to be applied for its development and thus no risk that any standard can hinder its development is foreseen. The SRMM is not generating situations that require update or new standard development. Because of these reasons, for current state analysis of the standardization landscape, this paragraph will be empty.

2.2.2 PASEU - Perception Engine

In CPSoSaware, Panasonic Automotive has delivered implementations of the perception engine on the Real Vehicle and on a multitude of platforms. Namely: Nvidia Drive-PX2, Raspberry pi, and TDA2X. The functionality developed and demonstrated in the automotive pilot of CPSoSaware tackles multi-disciplinary issues ranging from cyber-attack immunization to cooperative awareness, path planning motion control, and Driver state monitoring. Figure 2 illustrates all the software modules involved in the perception engine that contributed to CPSoSaware. The boxes presented in red constitute the end users function demonstrated through the pilot, with all other modules acting as the backbone of the functionality delivered in this pillar, as they get input from the aforementioned "end user modules" and deliver processed output to them as well.

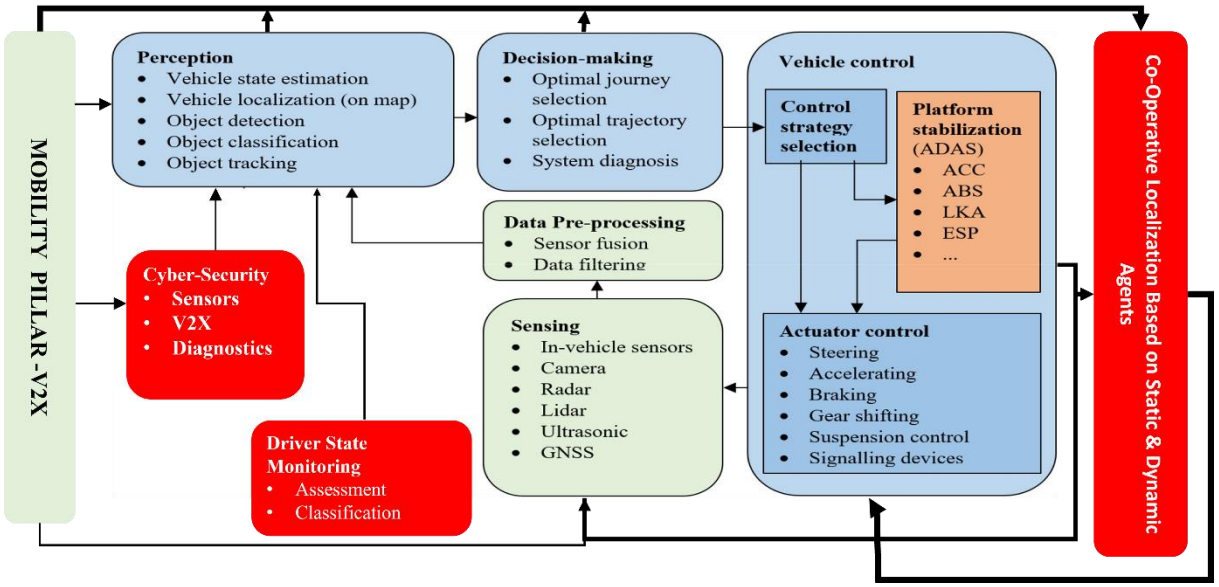

Figure 2: Architectural Pipeline of the solution contributed for the automotive pilot of CPSoSaware

For the proper implementation of the perception engine, throughout the development team the contributors had interacted with the following standardization bodies:

- IEEE- P2020 [1]:

The Standard tackles important aspects that contribute to image and signal quality for Advanced Driver Assistance Systems (ADAS) applications, while also introduces statistical evaluation metrics and other useful information regarding these attributes. IEEE-P2020 [1] launches a standardized suite of objective and subjective test methods for quantifying the levels of automotive camera image quality. Moreover, it specifies test protocols and tools to facilitate standards-based communication and comparison among OEM and Tier 1 system integrators and component vendors regarding automotive ADAS image quality. The standard specifies benchmarks and key performance indicators for measuring and testing automotive image quality to ensure consistency and create cross-industry reference points.

- ADASIS [2]/ SENSORIS [3]:

SENSORIS [3] and ADASIS [2] aim at defining data structures for wirelessly communicating object detection and HD map data respectively proposing a cloud-based framework for sharing vehicle data. The goal constitutes an appropriate interface for exchanging information between the in-vehicle map database, ADAS, and automated driving applications.

a) Determine a list of ADAS and/or automated driving requirements necessary for the creation or generation of the ADAS horizon.
b) Define a standardised interface to enable ADAS applications to access this ADAS horizon.
c) Define the functional architecture necessary to build the ADAS horizon, including a representation of its evolution over time.
d) Define the software interface specifications necessary to build/access the ADAS horizon, including the protocols necessary to handle the required data stream.
e) Define a standardised data model to represent map data and other georeferenced data ahead of the vehicle.

2.2.3 8BELLS - Provision of Services Referring to Simulation Orchestration, Containerization, Environment Setup

8BELLS result regarding the orchestrator MOZART, has no content related to standardization . For this reason, this paragraph will be empty. No specific standardization has to be applied for its development and thus no risk that any standard can hinder its development is foreseen. "MOZART" is not generating situations that require updates or new standard development. Because of these reasons, for the current state analysis of the standardization landscape, this paragraph will be empty.

2.2.4 CATALINK - Driver State Monitoring

The DSM/OSM is analysing the faces of the driver/operator and detects signs of tiredness and dizziness. In case the detection is positive it generated a warning on the android mobile phone. It is not used for control, and it is interacting only through a warning, leaving the system the possibility to record events (not videos) and to receive the warning. The program on the device itself is not directly generating risks and does not need to respect dedicated standards; its use is depending on the driver or on the integrator of the workcell and eventual standards might be affecting only the use, but not the program itself.

2.2.5 CATALINK - Semantic Information Fusion Framework

Within the CPSoSaware project CTL participated as one demonstrator in the OntoCommons H2020 CSA project[1] with the Semantic Information Fusion Framework. Although it is not an industry standard, OntoCommons is a project dedicated to the standardization of data documentation across all domains related to materials and manufacturing, and one of its goals is to include a number of recommendations for policy instruments towards Data Sharing for the European Single Market. Within OntoCommons, CTL provided a demonstrator related to the monitoring of human operators' safety and well-being via semantic data integration in an automotive manufacturing setting. The latest resources with regards to this demonstrator are available at the following public GitHub repository: https://github.com/catalink-eu/ontocommons. The repository also contains information about

[1] https://ontocommons.eu/

the current deployment, as well as instructions on how to run the ontology populator (Java code). Part of this work was accepted for presentation at the Industry Track of the 2022 Extended Semantic Web Conference[2] and was published in the conference proceedings.

2.2.6 ROBOTEC - V2X Simulation

In the CPSoSaware project, there were 2 alternative implementations of V2X communication simulation frameworks prepared by I2CAT and ROBOTEC. Such simulations were necessary for the evaluation of Cooperative Awareness scenarios, so to assess the value of direct communication between vehicles and other traffic agents on the performance of ADAS and Autonomous Driving algorithms.

Vehicle-to-everything (V2X) is a concept of communication between vehicles and any other traffic agents that the vehicles can interact with (pedestrians, traffic lights, traffic signs, etc.). The main motivations for introducing V2X are safety, and improved path/velocity planning (energy saving and increased traffic efficiency).

For proper simulation of the V2X communication in the CPSoSaware project, the standards of such communication had to be considered. There are two most important industry standards regulating vehicular communication:

- IEEE 802.11p - https://standards.ieee.org/ieee/802.11p/3953/ - IEEE Standard for Information technology-Local and metropolitan area networks- Specific requirements- Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications Amendment 6: Wireless Access in Vehicular Environments - this amendment specifies the extensions to IEEE Std 802.11 for wireless local area networks (WLANs) providing wireless communications while in a vehicular environment.
- 3GPP C-V2X - https://www.arc-it.net/html/standards/standard1439.html - this standard represents the subset of the 3GPP Release 14 specification in combination with IEEE 1609.3 and SAE 3161 standards that define Cellular Vehicle-to-Everything (C-V2X), which uses device-to-device communication (PC5) at 5.9GHz without requiring the presence of a base station.

CPSoSaware V2X solution satisfies the requirements of both of these standards and was created according to the recommendations provided within the documents, especially with regard to the frequency band used.

2.2.7 ISI – Cooperative Awareness Solutions

The cooperative awareness solutions are a suite of software modules optimized to be executed on SoCs, providing centralized and decentralized fusioning of extracted information from different modalities, towards solving problems related to CPSs localization, user state evaluation and path planning. Those novel schemes have been designed and tested using open automotive datasets and data generated from autonomous driving simulator's and from the automotive and manufacturing pilots. Those solutions have been tested under various traffic and environmental scenarios utlilizing various available modalities e.g., a LIDAR, a RGB camera, a GNSSS, and an IMU but have been also deployed in the vehicle of Panasonic and in the CRF site to detect more accurately human landmarks from various cameras. Additionally, different odometry functionalities are provided, utilising different modalities (LIDAR, RGB cameras, IMU), producing an estimated path which have been thoroughly compared against ground truth measurements (e.g., DGPS measurements in the case of the real vehicle or trajectories provided by Automotive simulators) with the aid of metrics like the Absolute Trajectory Error (ATE) and Relative Pose Error (RPE) producing valuable insights about the reliability and the robustness of the different implementations.

[2] https://2022.eswc-conferences.org/wp-content/uploads/2022/05/industry_Kontopoulos_et_al_paper_205.pdf

The Cooperative localization solutions assume that node communicate based on the 802.11p standard, while multimodal perception and cooperative scene understanding solutions in the automotive domain, are fully aligned with the US NCAP roadmap that include high-resolution object detection technology for a path toward L2+ class ADAS and pedestrian safety.

2.2.8 ISI – Quantum Resistant Hardware Security Token

The ISI QR Hardware Security token can perform a series of Cryptography/security primitive operations that are usable for a series of security operations for achieving confidentiality, integrity and availability (CIA) as well as authenticity. Such security operations follow well defined and widely accepted security and cryptography standards from the US National Institute for Standards and Technology (NIST/FIPS) as well as IETF and ISO/IEC. The overall series of security/cryptography primitives can be categorized into cryptography key agreement schemes, digital signature schemes, symmetric key cryptography schemes as well as TLS security protocol.

The following are some of the most important standards

- FIPS 140-3: Security Requirements for Cryptographic Modules: The standard provides guidelines for the cryptography algorithms to be used in a cryptography module so as to be considered secure enough for commercial applications. It provides lists of cryptography ciphers to be used as well as the security level of each algorithm (the key sizes etc).
- ISO/IEC 15408-1/2/3:2005 - Information technology — Security techniques — Evaluation criteria for IT security: The Standard containing a common set of requirements for the security functions of IT products and systems and for assurance measures applied to them during a security evaluation. The standard consists of 3 parts focusing on the general concepts and principles of IT security, the functional security requirements and the security assurance requirements for a given security token.
- IETF TLS 1.3 standard: This document specifies version 1.3 of the Transport Layer Security (TLS) protocol. TLS allows client/server applications to communicate over the Internet in a way that is designed to prevent eavesdropping, tampering, and message forgery.

Quantum Resistant standardization effort: Although not yet fully standardized, the QR hardware Security token follows the standardization process of IETF and NIST regarding the quantum resistant transition of public key cryptography cipher that are used in most security protocols. As such, the QR HST supports all the selected for standardization postquantum cryptography algorithms and offers preliminary support for the on-going relevant standardization efforts.

2.2.9 IBM – Data Storage

This is an adaptable, modular Data Storage that allows the storage of different Data types and schemes with a very easy preparation. The User should supply the format of the data he wishes to store ahead and can also choose how the data would be represented when retrieved. The data storage is modular, and it is possible to manage "data Hierarchy", such that one piece of data in one table can be connected to some different tables. The distinguished feature of the platform is a data transformation module that enables ontology alignment capability. The ontology alignment capability based on the equivalence rules that are provided in an SQL-like language. These rules allow to declare equivalence between data classes and properties of this classes, as well as between simple and aggregative functions of instances and properties of corresponding classes. Once equivalence rules are defined data could be automatically connected and transformed allowing to build single dataset from the data that comes from the different data sources.

The access to the data storage is due to completing an authentication process. The Data storage is available from web, and it also accepts URL requests so an automized data posting is also supported.

2.2.10 TAU – PoCL-R for distributed edge offloading

The work on the heterogeneous distributed software stack was carefully carried out adhering to open application programming interface standards. The standards that were involved with were OpenCL, SPIR-V and OpenVX all of which maintained by the Khronos Group, consisting of industry leaders of heterogeneous platform experts and their users. In addition, the AlmaIF v2 hardware IP wrapper, which was used for portable FPGA IP block integration and interfacing to the common open-source OpenCL implementation platform, PoCL, utilized the Heterogeneous Systems Architecture (HSA) specification as a basis for its in-memory command queue format.

The work mostly utilized existing standards since it was the key point to remain cross-vendor compatible and minimize ad hoc extensions to the standards. However, since it was identified that achieving low latency relaunches of application command queues required a buffering mechanism for the command structures itself, TAU participated in defining the cl_khr_command_buffer extension of OpenCL and its multi-device version (pending publishing in IWOCL 2023 conference). TAU's research group provided rapid feedback to the proposal as well as a test implementation of it in PoCL, helping to get these very important extensions polished in a releasable form. "

2.2.11 CRF - Collaborative Robotic Cell for Windshield Preparation

The full robotic workcell is designed and integrated according to existing standards and uses (for its Safety related functionalities) devices with a declaration of incorporation for PLd Cat3 machines. As declared in D6.5, being the use-case related to Human Robot Collaboration, stringent safety requirements take place in its set-up (D1.2 in paragraph "2.3.2 Human Robot Collaboration rules according to ISO Standards"). As stated in the previously cited paragraph of tD1.2, the most relevant standards to be considered in the definition of a collaborative workcell are:

- EN ISO 10218-2:2011 sets the allowed behaviour of the COBOT in Human Robot Collaboration applications, through the definition of the collaborative modes and the rules for the integration in the collaborative workspace (targeted to integrators);
- EN ISO 10218-1:2011 that sets the hardware and functional safety characteristics that a collaborative robot has to fulfil (targeted to robot's constructors);
- ISO/TS 15066:2016 sets the numerical limits for the physical KPIs (velocity, force, power…), and the methodologies for workplace safety in Human Robot Collaboration (HRC) applications.

While ISO 10218-2 and ISO/TS 15066, define the functional rules for the Safe applications to be certified and consistent, ISO 10218-1 and all its cited standards define the criteria for the hardware to be certified as incorporable in the final certified machine according to the "*DIRECTIVE* 2006/42/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 17 May 2006 on *machinery*, and amending *Directive* 95/16/EC".

Considering that the technologies developed in CPSoSaware can give support to the safety of the application, but don't have the nature in terms of the type of functionalities, nor the certification to be considered Safe machines, (Cat 3/PLd according to ISO 13849-1), the manufacturing use case has been designed to implement a unique and homogenous system of tools (systems) supporting safety, while not being "safe" themselves.

The workcell is designed to be inherently Safe and certified for Safety and uses the information arriving from the CPSoSaware system only to parametrize the height of the gripper (the end-effector acting as a manipulator of the windshield and adaptive table for the assembly tasks performed by the operator). In order to achieve the safety certification of the workstation, the CPSoSaware technologies operate only at the informational level with respect to the actions performed by the robot without influencing or directly controlling the motion of the robot. The workcell structure is made in a way that the application itself is inherently safe also without the information from the CPSoSaware modules or in any case of failure from the CPSoSaware system.

In the standard application implemented on the workcell a Safe Robot (KUKA KR150), equipped with the KUKA.SafeOperations SW module, picks up the windshield and goes to a collaborative position while all the zones of potential interaction between the robot and the human are monitored from an external 3D Safety monitoring system (The PILZ Safety Eye) which is ensuring that the operator can never enter in contact with the robot while this is moving. The Safety Eye control is obtained by stopping with a Safe Monitored Stop the robot in case of any violation or undesired interaction.

The presence of the Safety Eye that monitors the accesses from the operator, coordinated with the Safe zones definition in the KUKA.SafeOperations system and the proper programming of the access control cabinet make the application safe for standalone use. As an additional Safety Feature the robot is programmed at a low speed never exceeding 250mm/s.

Indeed, according to the relevant ISO standard the workcell in CRF can be certified for Safety if:

- The Robot is:
  - Safe (PLd – Cat3)
  - Equipped with soft Safety axis
- The operator
  - enters in contact only with the stopped robot (suggested) OR…
  - … the gripper is equipped with a Hand Guiding control (this feature is not installed nor considered in the CPSoSaware system)
- The Workplace
  - is monitored against operator's intrusions in the zones where the robot moves

Furthermore, additional safety can be obtained by supporting the operator with visual warnings/HMIs which is the HoloLens AR application developed in CPSoSaware.

The CPSoSaware subsystem doesn't directly influence the motion of the robot in any unpredictable way and thus they don't generate risks.

2.2.11.1.1 CRF - Note on video recording in Manufacturing Use-Case and exploitable results.

The use of cameras requires video recordings that are affected by the GDPR regulation; and require thus the acceptance by the operator. From another point of view, from European regulation on work, video recording for Safety reasons no explicit agreement has to be signed. All the developments, which are improving the Safety of the system are not constrained by the GDPR European regulation and may thus be integrated. Anyway, the following technical countermeasure is, or can be adopted to eliminate the risk of violation of regulations, laws or standards:

- Privacy by design and technology: The CPSoSaware approach enables a robust real-time scene understanding that does not require any video storage. Eventual video storage might be requested by regulation (Safety event tracing), but technologies for real-time body recognition and image ghosting exist for this case. For example, the Safety eye technology makes a recording of the scene since the understanding of violations is a critical aspect for safety, but the Human silhouettes are identified and masked in the recording and the operator can never be recognized by the video analysis afterward. The developed technologies are designed so that there is no need for video recording.
- The Anthropometric recognition by the video does not require the operator's identification and (if the videos are not recorded) it is respecting privacy in a better way than the use of the badge with a pre-recorded height of the operator.
- Ergonomics: all the CPSoSaware implementations in the manufacturing use-case are dedicated to operator's Safety, ergonomics, and well-being improvements, while ensuring operational continuum and thus productivity
- Safety: the system is designed to respect and improve all the Safety regulations for the operators.

2.2.12 CRF - Posture and Anthropometrics Recognition

Among the CPSoSaware systems installed, only the Anthropometric analysis module by UPAT can influence the motion of the robot, but its influence is asynchronous and cannot affect the Safety.

The Anthropometric analysis module performs recognition and classification of the operator's height and publishes in the ROS system a code reporting the to which range of heights the operator belongs (5 classes are identified). According to the specific height class, the robot positions the gripper at a different height from the ground to improve the ergonomics of the operator. During the task's execution, the robot picks up the windshield and makes a rotation inside in the Safe Area iii, which is protected against intrusions from the operator by the Safety Eye. At this moment, the robot reads the code related to the height class of the operator, and in the following phases the robot elongates completely toward collaborative working. The path that the robot follows in its movement from the grouped position to the elongated one is a predetermined path (one path per height class) which is bringing the gripper to a position in space changes only in the height from the ground. During all the movements, the operator is not allowed to enter in the robot moving zone. When the operator is enabled to access the robot is stationary in a Safe Stop position. In case a non-valid height class or no height class is provided when the robot reads the required value, the average value (class 3) is used to ensure a statistically reasonable height from the ground without interruptions in the robot's movements. We need to consider that in case no external height detection system is provided the height of the gripper would be fixed at the average position (corresponding to the 50 percentile of the operators). All the above description is detailed in D6.5.

Upon these considerations, the overall safety of the robot's motion cannot be hindered by the CPSoS system. On the other end the Augmented reality system developed has the possibility to act as an additional visual warnings/HMI integrating several functions as described in the following paragraphs. The AR system also performs on-demand training sessions enabling a further level of safety for the operator.

2.2.13 CRF - Extended Reality System with Multimodal Sensing

The AR application in Manufacturing applications is not considered intrinsically dangerous and has no direct connection with standardization. As a device itself, the HoloLens is Certified and has the CE mark and can thus be incorporated into the application. The device is not Safe according to ISO 13849-1 and cannot thus be used for Safety related. The use done is studied not to require functions that could be affected by Safety or special standard development request. Only Standards related to ergonomics on the job can be applied (number of hours, repetitive movements in the function of the worn weight, and so on) but this is not relevant at the technology development level and will thus be considered only during the application of the technology in a plant at TRLs higher than 9.

For all the exploitable results developed in the framework of the Manufacturing Use-case, no video recording is made necessary. As stated in "D8.6 – FINAL REPORT ON QUALITY, RISK MANAGEMENT PLAN AND ETHICS", this approach does not generate any risk of the GDPR 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).

3 Dissemination of CPSoSaware standardization and orchestration

A series of activities have been taken in order to achieve a level of dissemination toward standardization stakeholders considered satisfactory by the partnership.

These actions were mainly:

- Participation to the survey Code of Practice for Researchers on Standardization by the European commission
- Dedicated dissemination/standardization and joint workshops
- Internal partnerships' workshops and courses to increase the partnership's knowledge on standardization
- Standardization questionnaire in the CIAG meeting
- Application to the HS booster initiative

3.1 Survey "Code of Practice for Researchers on Standardization by the European commission"

The partnership was invited by the European commission to participate to the "Code of Practice for Researchers on Standardization" survey; a survey developed by the DG Research and Innovation as part Guiding Principles under development for knowledge valorisation. In this context, a set of codes of practice have been proposed in order to implement these Guiding Principles. One of these codes of practice will be a Code of Practice for researchers on standardization. This code will be co-created with relevant stakeholders to ensure its usefulness, relevance and create ownership.

The survey, though signed by the coordinator, was prepared, and compiled by the coordinator and by CRF (responsible for the task T7.3 on standardization and orchestration activities). For its preparation partners more strongly involved in the standardization activities, like the above cited PASEU and CTL, were also involved. The compilation (attached in 6.2: Annex 2 – compilation of survey "Code of Practice for Researchers on Standardization") was made in a limited series of meeting to prepare a single unified version of the standardization vision of the project. The survey was afterward compiled separately by the coordinator. A good extract of the vision of the partnership in terms of standardization is described in the attached questionnaire and will not be repeated in detail here. In relation to the target of the questionnaire, it is evident that the approach to standardization has to consider during project execution (in particular to guide the realization of outputs that can be reaching commercialization and thus improve the strength of the exploitation), on the other end its application can be not fundamental, especially at low TRL were it could also jeopardize the achievement of technical results.

3.2 Dedicated dissemination/standardization and joint workshops

In the following table a list of actions by the partnership, taken with the aim to disseminate the CPSoSaware contents and approach in relation to standardization are listed in Table.

Table 3: CPSoSaware actions toward standardization stakeholders, or standardization related dissemination contents.

Partner Name	Date	Audience	Activity	Comments
CRF	1Q 2022	UNI/ISO	Working group	CRF introduced aspects related to ISO 10218 with participants to the UNI/ISO Italian working group on Robotics from COMAU. CRF is also participating in the workgroup. Though this channel CRF could invite CIAG members from COMAU, but made a separate dissemination action with them
PASEU	2022	IEEE Standards	WG: Automotive Image Quality for Computer Vision	PASEU Leads the Working Group of Computer Vision on Automotive Image Quality. We can introduce some metrics of image quality degradation also used on Cyber Attack use case: Skorka, Orit; Romancyzk, Paul. A review of IEEE P2020 noise metrics. Electronic Imaging, 2022, 34: 1-6.
PASEU	-	ADASIS Hosted By ERTICO	Co Operative Awareness	The consortium can align on which of the conclusion of cooperative awareness can be pushed in the standard
CTL	-	ISO	paper	Publication on standardizing semantics enabled ETL tools and semantic data integration framework (T4.5)
CTL	-	ISO	paper	Publication on standardizing Driver State Monitoring
CRF	30/09/2022	European Commission	HS Booster	Horizon standardization booster supported by the European Commission
CTL	7-8/11/2022	Ontocommons partnership and use-cases leaders	Ontocommons	Paper form Stelios Kontogiannis (CTL) on "CPSoSaware: Monitoring human operators' safety, well-being via semantic data integration in an automotive manufacturing setting" in the context of the Ontocommons workshop: " OntoCommons Demonstrators and Use Case Workshop - Demonstrate the power of Standardization!"
ISI/CRF	07/10/2022	Cyrene Project	Presentation and discussion in Cyrene Project about the CPSoSaware project	Presentation by Apostolos Fournaris in the context of the CYRENE project's "Cyrene INFO Day" entitled "Certifying the Security and Resilience of Supply Chain Services" on Security and standards related topics. Organized by CRF on 7/11/2022
TAU	15/11/2022	Portable Computing Language, PoCL developers	Publication: Advanced hardware accelerator support through AlmaIF	T. Leppänen, P. Mousouliotis, G. Keramidas, J. Multanen and P. Jääskeläinen, "Unified OpenCL Integration Methodology for FPGA Designs," 2021 IEEE Nordic Circuits and Systems Conference (NorCAS), 2021, pp. 1-7, doi: 10.1109/NorCAS53631.2021.9599861.
CRF/ISI	30/09/2022	Indirectly European Commission by HS booster application	HS booster application	The project applied to the initiative, but activities are not yet started.

3.3 Partnership's Internal workshops

The main and general concepts described in chapter 2 of deliverable D7.5 are describing the way the standardization offices and international organization work starting from the value and meaning of a standard (also in terms of their relationship with local or international legislation and regulation, to the international structures and standardization bodies managing and proposing standards to the technical international community and finally to the main procedures and approaches necessary to propose new topics, standards or technical specification into the standardization landscape. All these concepts are fundamental for enabling technical partners of the project to understand the importance of standards, their application, and the procedures to approach standardization bodies. Because of this reason, after the submission of D7.5 and with the aim to simplify the partners' participation in the standardization activities the above topics have been presented in the context of the first general assembly after the Mid Term Review in order to push and guide the collaboration of the partnership toward the standardization activities. In several General Assemblies and joint meetings, the standardization achievement was presented to increase internal partnership's awareness.

3.4 Standardization questionnaire with CIAG members

The consortium, during the CIAG meeting, made presentations of the technologies used in the CPSoSaware project and proposed a questionnaire to the CIAG members with questions related to standards for each presented technology. Through this approach the partnership aims at receiving targeted feedback toward standardization issues focused on the developed exploitable results.

3.4.1 CIAG organization

For the organization of the event the partnership invited experts external to the project. The number of external experts was kept to a reasonable and sufficient level for the aims of the CIAG. Seven experts were invited. All the experts received an invitation to the CIAG meeting; all the experts got access to the presentations and received the material, but only those who attended the meeting, could participate in the remote survey organized (see detailed in D7.8) . The following Table 4 lists the invited experts with a short outline of their expertise.

Table 4: List and profiles of representative of the CIAG group

Name	Description	Representative in CPSoS CIAG
NOESYS Research Group & National and Kapodistrian University of Athens (NKUA) noesis a Cybernet Group Company National and Kapodistrian University of Athens	The Intelligent Wireless Systems and Information Processing Algorithms (NOESYS) research group. The National and Kapodistrian University of Athens is the oldest higher education institution of the Greece and the first contemporary university in both the Balkan Peninsula and the Eastern Mediterranean.	**Prof. George Alexandropoulos**, Assistant Professor, leader in NOESYS Research Group, in the Department of Informatics and Telecommunications, of National and Kapodistrian University of Athens (NKUA).

Huawei Technologies Sweden AB (www.huawei.com/se) 	Huawei is a leading global provider of information and communications technology (ICT) infrastructure and smart devices.	**Dr. Pouria Khodashenas**, Principal Researcher 5.5G / 6G at Huawei | Green & Digital Transformation Specialist Industry 4.0 & CCAM / CA.
Kenotom (https://www.kenotom.com) 	Kenotom is an engineering services provider for Embedded and Control Technology.	**Mr. Athanasios Athanasiadis**, Athanasios has more than 5 years of experience in Automotive industry with responsibilities in the Automotive SW Test & Validation. During the past 2 years he has been working on an ADAS project Kenotom, where they develop software for embedded systems in the automotive sector.
Aristotle University of Thessaloniki (https://www.auth.gr/en/) 	The Aristotle University of Thessaloniki is the largest university and among the most highly ranked in Greece.	**Prof. Dimitris Vrakas**, Assistant Professor, Dept. of Informatics, Aristotle University of Thessaloniki, Greece.
Inertia Technology (https://inertia-technology.com/) 	Inertia is specialized in the development of miniaturized wireless devices that can sense, process and communicate motion, vibration and orientation features of interest.	**Dr. Mihai Marin-Perianu**, managing director of Inertia. Inertia is specialized in the development of miniaturized wireless devices that can sense, process, and communicate motion, vibration and orientation features of interest.
Comau (https://www.comau.com/en/) 	Comau is an Italian multinational company in the automation field. The company provides services, products and technologies for automotive industry, shipping industry, logistics, food and beverage industry, packaging, electrification, renewable energy, and heavy industry.	**Mr. Gian Paolo Gerio**, Development Chapter Manager. Comau is a leading company in the industrial automation field, at a global level. Combining innovative engineering solutions with easy to use, open automation and enabling technologies, Comau helps companies of all sizes – and across a wide range of industrial segments – leverage the full potential of digital manufacturing. Comau's competency stems from over 45 years of field proven-experience and a strong presence within every major industrial country. COMAU is responsible of the UNI group related to Robotics.

Vrije Universiteit Brussel (https://www.vub.be/nl)	The Vrije Universiteit Brussel (VUB) is a Dutch and English-speaking research university located in Brussels, Belgium. VUB is a strongly research-oriented institute, which is positioned among the world's Top 200 universities according to the 2021 QS World University Ranking.	**Prof. Bram Vanderborght**, Vrije Universiteit Brussel, Faculty of Applied Sciences, Department of Mechanical Engineering. Robotics & Multibody Mechanics (R&MM). Expert for the European commission in field of ethical aspect of Cyber Physical Systems. Among the authors of the EC scientific foresight study for ethics on CPS (Figure 3.)

The CIAG meeting was organized with:

- A short introduction
- A presentation for each of the envisaged exploitable results
- The answer to the online survey, brief preliminary feedback from all the experts.

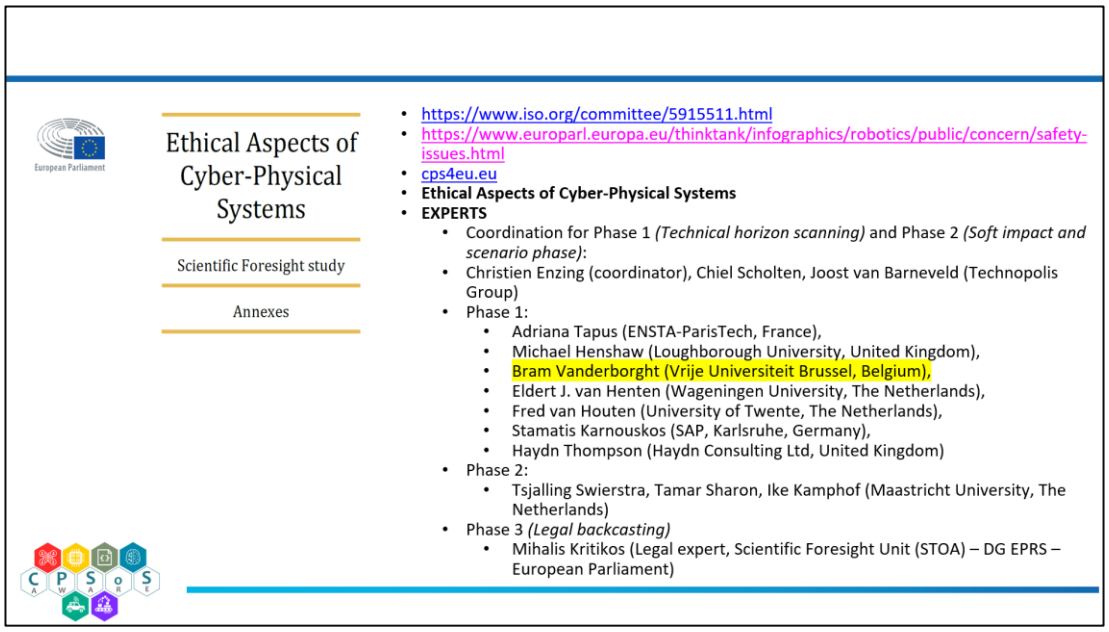

Figure 3: European scientific foresight on Ethical aspects of CPSs with the list of experts.

In all presentation and discussions, both technical and standardization aspects were discussed.

This activity was coordinated directly by ROBOTEC AI (RTC) with CRF for the standardization aspects and with the support of all the other partners.

3.4.2 Standardization questionnaire

The final part of the CIAG meeting was dedicated to a questionnaire targeted to receive feedback from the experts. As stated, part of the questionnaire focused on standardization activities. These questions may not be discussed in

detail during the meeting due to the limited time available. The overall questionnaire consisted of a total of 49 questions. The results obtained are collected and represented in paragraph 6.4 Annex 4 – Feedback to Standardization related questions for the CIAG meeting survey.

3.4.3 Results

Analysing the responses received from the experts involved, we can conclude that the project provides a promising set of solutions and technologies. In particular, potential connection points with existing and evolving standards that should be explored in the following areas:

- V2X communication framework (simulator)
- Data storage and transformation engine
- Quantum Resistant Hardware Security Token

The risk of regulatory interference is relatively low. The most relevant keywords would be security (for Cooperative Awareness Solutions, Quantum Resistant Hardware Security Token, and Security Runtime Monitor Module), privacy (for Driver State Monitoring and Operator's state monitoring), and safety at work and ergonomics (for Extended Reality System in HRC application and Posture and Anthropometrics Recognition).

In terms of privacy, the European GDPR regulation could increase the difficulties and create possible slowdowns.

3.5 HS booster

HS booster.eu is a promoted initiative of the European Commission for a total duration of 24 months which will provide the European Standardization Booster. The goal will give the possibility to use the services of experts to European projects to help them increase and valorise project results by contributing to the creation or revision of a standard.

As a partner of the CPSoSaware project we have forwarded our application and we have been included in the projects for which we ask for support in terms of standardization.

Figure 4: HS Booster Homepage[3]

[1]. [3] https://www.hsbooster.eu/about-0

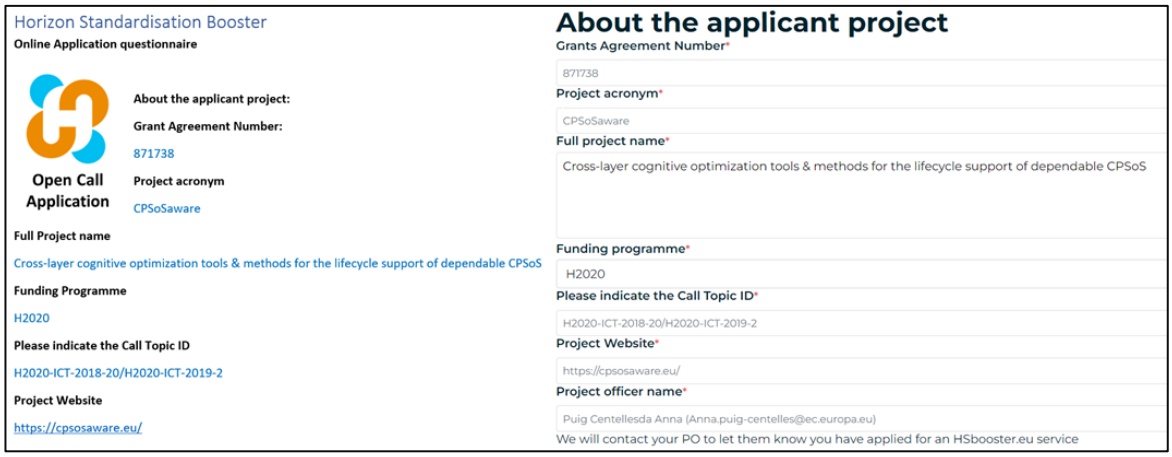

Figure 5: Online Application questionnaire for HS Booster

3.5.1 Application

The partnership made the application for the service. The selected field of interest are listed in the following figure:

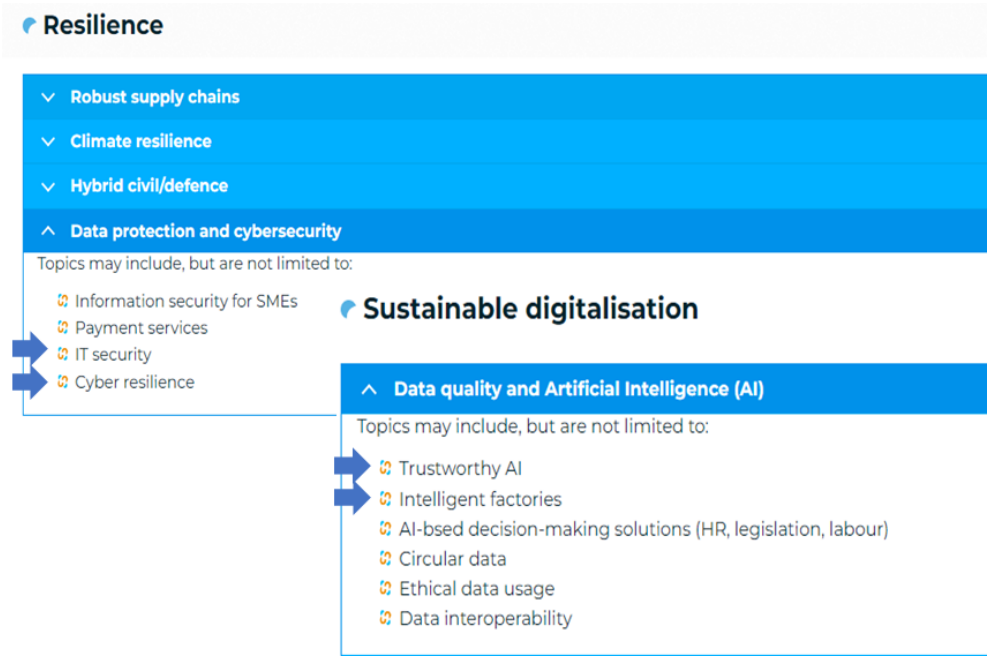

Figure 6: Online Application questionnaire for HS Booster: fields of interest part 1

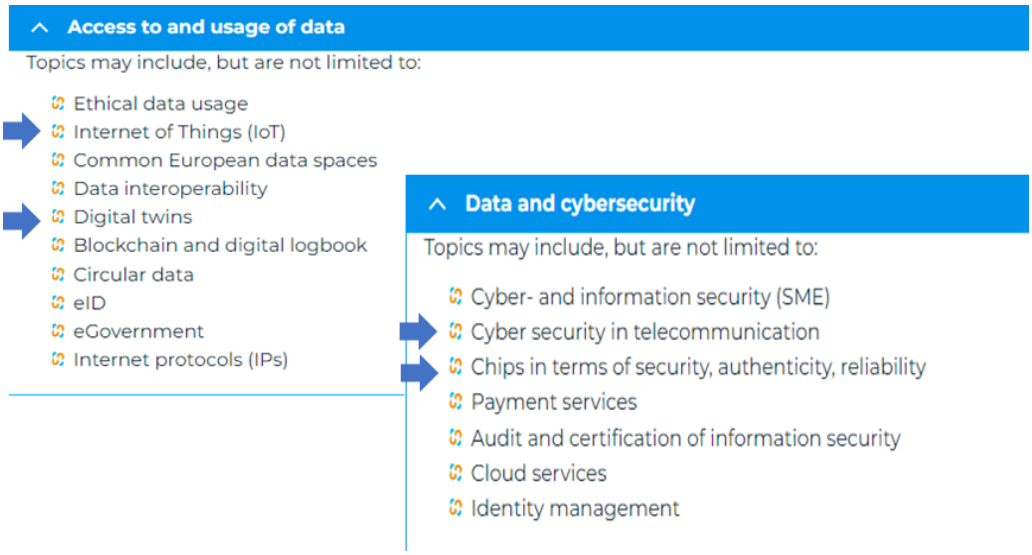

Figure 7: Online Application questionnaire for HS Booster: fields of interest part 2

Figure 6 and Figure 7, are a snapshot of the fields of interest treated in the CPSoSaware project ad for which the consortium applied to the HS booster initiative. According to these selected fields of interest, the expert for the next steps have been identified and proposed by the HS booster organization.

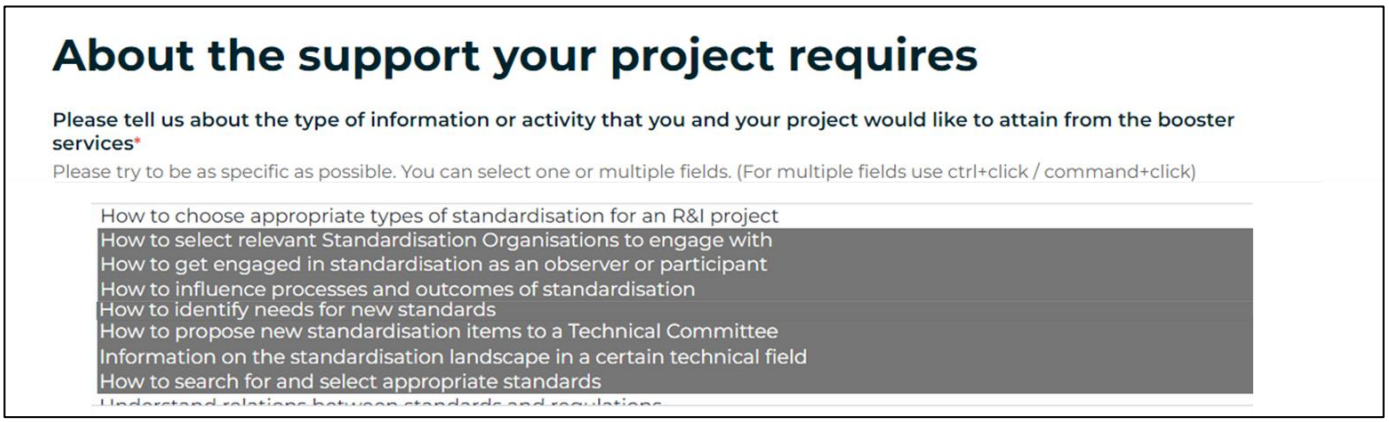

Figure 8: Online Application questionnaire for HS Booster: Type of support requested and desired

On 10 January we received confirmation that the service is ready to start and that the expert Raul Garcia Castro, a researcher at the Polytechnic University of Madrid, has been entrusted to the CPSoSaware project.

The main topics concerned by the identified expert are:

- Data quality and Artificial Intelligence
- Data interoperability
- Data access and use
- Data interoperability
- Digital twins
- Internet of things

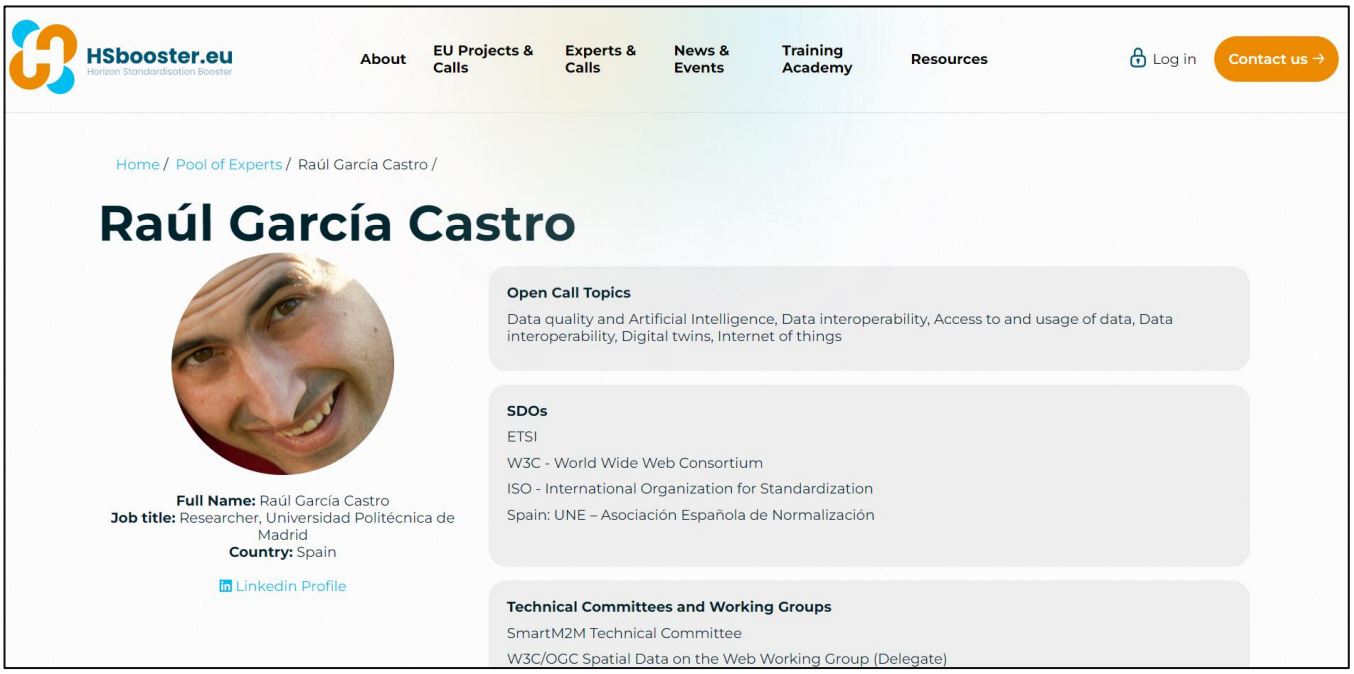

Figure 9: HS Booster: profile of the assigned expert

After identifying the expert who will support us in the standardization activities, we have planned a first meeting scheduled on February 6, 2023, with the aim of examining together:

1. What is the project status? This includes a topic, consortium members, timeline, the aim of the project, project maturity, finance, and project PI
2. Expected results for the service. This includes: What is your starting point and what do you expect to gain through the HSbooster services and receive from me as an expert?

The date for the meeting is after the end of the CPSoSaware project, yet the project will participate (represented by CRF, ISI, CTL, and 8bells) in order to discuss the next actions and efforts; according to the planning and the achieved results, CRF, as standardization manager will forward the received information to interested partners.

The comments and observations derived from this, and the following meeting will be collected and shared later.

4 Conclusions

CPSoSaware project has been analysing the standardization landscape related to its development all through the duration of the project. The main approach was the creation of standardization awareness in the partnership. As a consequence, most of the development has been made for accessibility to the market since avoiding collisions with existing standards and avoiding developments that could need new standards or modifications of existing ones. Because of these reasons, direct actions toward standardization bodies did not become necessary. Nevertheless, the partnership has been publishing papers and participating in conferences or workshops related to the standardization field with the aim to disseminate the project's content and eventually receive feedback indicating the needs to make further standardization approaches.

With the same objective, the Standardization and orchestration task (T7.3) have been using the CIAG meeting and its discussion with experts on the field to discuss about evident relationships with existing standards,

The partnership also applied to the European Standardization Booster “HS booster” in order to highlight further connections to the standardization landscape and to disseminate the CPSoSaware development toward standardization experts.

Al the developed actions are listed in this deliverable D7.10.

5 References

[1]. Skorka, Orit; Romancyzk, Paul. A review of IEEE P2020 noise metrics. Electronic Imaging, 2022, 34: 1-6.

[2]. Piecha, P. (2022). Development of a Driving Range Function Based on E-Horizon Information. ATZ worldwide, 124(6), 48-51.

[3]. Varga, B., Szalai, M., Fehér, Á., Aradi, S., & Tettamanti, T. (2020). Mixed-reality Automotive Testing with SENSORIS. Periodica Polytechnica Transportation Engineering, 48(4), 357-362.

6 ANNEXES

6.1 Annex 1 - Current Reference standards

Table 5: List of standards identified as "of interest" by the partnership.

Document identifier	Title	Abstract	Committee reference	Publication date	Legal connection / value	Category	Use Case	How does the standard have an impact on CPSoSaware contents?
ISO/IEC 15938	DSM standards for video analysis	MPEG-7 is a multimedia content description standard. It was standardized in ISO/IEC 15938 (Multimedia content description interface). This description will be associated with the content itself, to allow fast and efficient searching for material that is of interest to the user. MPEG-7 is formally called Multimedia Content Description Interface. Thus, it is not a standard which deals with the actual encoding of moving pictures and audio, like MPEG-1, MPEG-2 and MPEG-4. It uses XML to store metadata and can be attached to timecode in order to tag particular events, or synchronise lyrics to a song.	MPEG-4, MPEG-7	2015	No	Safety	ADAS	Adopt MPEG-4, MPEG-7, AVI to include several encoding/decoding and multimedia metadata to the processed video data
OWL 2 Web Ontology Language	Ontology language for creating semantic models (W3C Recommendation)	The OWL 2 Web Ontology Language, informally OWL 2, is an ontology language for the Semantic Web with formally defined meaning. OWL 2 ontologies provide classes, properties, individuals, and data values and are stored as Semantic Web documents. OWL 2 ontologies can be used along with information written in RDF, and OWL 2 ontologies themselves are primarily exchanged as RDF documents.	OWL2	41254	No	ICT	ADAS	OWL2 is a W3C standard for semantics-enabled knowledge representation. Adopting this standard provides semantic interoperability with other existing models.
SPARQL 1.1 Query Language	Query language for querying semantic models (W3C Recommendation)	RDF is a directed, labelled graph data format for representing information in the Web. This specification defines the syntax and semantics of the SPARQL query language for RDF. SPARQL can be used to express queries across diverse data sources, whether the data is stored natively as RDF or viewed as RDF via middleware. SPARQL contains capabilities for querying required and optional graph patterns along with their conjunctions and disjunctions. SPARQL also supports aggregation, subqueries, negation, creating values by expressions, extensible value testing, and constraining queries by source RDF graph. The results of SPARQL queries can be result sets or RDF graphs.	SPARQL	41354	No	ICT	ADAS	SPARQL is the de facto standard, for querying semantic models and ontologies.

Shapes Constraint Language (SHACL)	Standard for validating semantic models (W3C Recommendation)	The SHACL Shapes Constraint Language is a language for validating RDF graphs against a set of conditions. These conditions are provided as shapes and other constructs expressed in the form of an RDF graph. RDF graphs that are used in this manner are called "shapes graphs" in SHACL and the RDF graphs that are validated against a shapes graph are called "data graphs". As SHACL shape graphs are used to validate that data graphs satisfy a set of conditions they can also be viewed as a description of the data graphs that do satisfy these conditions. Such descriptions may be used for a variety of purposes beside validation, including user interface building, code generation and data integration.	SHACL	42936	No	ICT	ADAS	SHACL is a W3C standard widely adopted by industry for validating semantic models.
SWRL: A Semantic Web Rule Language Combining OWL and RuleML	Rule language for executing rules over RDF/OWL data	The Semantic Web Rule Language (SWRL) is based on a combination of the OWL DL and OWL Lite sublanguages of the OWL Web Ontology Language with the Unary/Binary Datalog RuleML sublanguages of the Rule Markup Language. SWRL includes a high-level abstract syntax for Horn-like rules in both the OWL DL and OWL Lite sublanguages of OWL. A model-theoretic semantics is given to provide the formal meaning for OWL ontologies including rules written in this abstract syntax. An XML syntax based on RuleML and the OWL XML Presentation Syntax as well as an RDF concrete syntax based on the OWL RDF/XML exchange syntax are also given, along with several examples.	SWRL	38128	No	ICT	ADAS	SWRL is not yet a W3C recommendation, but offers a competitive advantage as far as simplicity of expressing rules is concerned. Alternatively, we may adopt SPARQL-based rules.
R2RML: RDB to RDF Mapping Language	Language for mapping data from relational DBs to RDF-based semantic models (W3C Recommendation)	R2RML is a language for expressing customized mappings from relational databases to RDF datasets. Such mappings provide the ability to view existing relational data in the RDF data model, expressed in a structure and target vocabulary of the mapping author's choice. R2RML mappings are themselves RDF graphs and written down in Turtle syntax. R2RML enables different types of mapping implementations. Processors could, for example, offer a virtual SPARQL endpoint over the mapped relational data, or generate RDF dumps, or offer a Linked Data interface.	R2RML	41179	No	ICT	ADAS	Within CPSoSaware, we will deploy CTL's CASPAR framework for ETL processes, which provides competitive advantages compared to R2RML.

ISO 26262-1:2018	Road vehicles — Functional safety (26262-1:2011, Revised 1:2018)	ISO 26262 is intended to be applied to safety-related systems that include one or more electrical and/or electronic (E/E) systems and that are installed in series production passenger cars with a maximum gross vehicle mass up to 3 500 kg. ISO 26262 does not address unique E/E systems in special purpose vehicles such as vehicles designed for drivers with disabilities. Systems and their components released for production, or systems and their components already under development prior to the publication date of ISO 26262, are exempted from the scope. For further development or alterations based on systems and their components released for production prior to the publication of ISO 26262, only the modifications will be developed in accordance with ISO 26262. ISO 26262 addresses possible hazards caused by malfunctioning behaviour of E/E safety-related systems, including interaction of these systems. It does not address hazards related to electric shock, fire, smoke, heat, radiation, toxicity, flammability, reactivity, corrosion, release of energy and similar hazards, unless directly caused by malfunctioning behaviour of E/E safety-related systems. ISO 26262 does not address the nominal performance of E/E systems, even if dedicated functional performance standards exist for these systems (e.g. active and passive safety systems, brake systems, Adaptive Cruise Control). ISO 26262-1:2011 specifies the terms, definitions and abbreviated terms for application in all parts of ISO 26262.	ISO/TC 22/SC 32	2011-11-00	Yes-Functional Safety	Safety	Automotive	The standard defines the diagnostics that need to run on the sensors as well as the level off autonomy that needs to be satisfied by eash software module integratedd on the platform.
ISO/TC 204	Intelligent transport systems	Standardization of information, communication and control systems in the field of urban and rural surface transportation, including intermodal and multimodal aspects thereof, traveller information, traffic management, public transport, commercial transport, emergency services and commercial services in the intelligent transport systems (ITS) field. ISO / TC 204 is responsible for the overall system aspects and infrastructure aspects of intelligent transport systems (ITS), as well as the coordination of the overall ISO work programme in this field including the schedule for standards development, taking into account the work of existing international standardization bodies.	ISO/TC 22/SC 32	The standard is under development	No-The Standard is under development	Others	Automotive	The standardization on the communication and control protocols directly affects the Co-operative situational awareness
ISO/TC 22	Road Vehicles	In 2017, ISO/TC 22 Road vehicles created an ad hoc group (ADAG for Automated Driving Ad hoc Group) in order to propose a consolidated mid-to-long term TC 22 roadmap of automated driving standards development (resolution 914 in October 2017). The main tasks were: (1) To set up the mapping of needed AD projects developed/to be developed in ISO/TC 22 subcommittees; (2) To coordinate mapping of actions being taken by ISO/TC 22 sub-committees so as to identify gaps and redundancies as well as opportunities for collaboration; (3) To promote and facilitate collaborative action to align ISO/TC 22 sub-committees' activities so as to close gaps in an optimal manner; (4) To provide ISO/TC 22 with practical guidance for approaches needed to ensure effective global action to address AD standardization issues, including options to improve coordination with other organizations (i.e. ISO/IEC JTC 1…)/committees (i.e. ISO/TC 204…); (5) To explore the feasibility of developing global goals and ambitions related to AD standardization in cooperation with other organizations/committees; (6) To regularly report on work progress to the ISO/TC 22 SAG.	ISO/TC 22/SC 32	The standard is under development	No-The Standard is under development	Safety	Automotive	The Standard is being observed by the Consortium as it tackles issues related to Co-Operative Situational Awareness

NHTSA	Federal Motor Vehicle Safety Standards and Regulations	The National Highway Traffic Safety Administration (NHTSA) has a legislative mandate under Title 49 of the United States Code, Chapter 301, Motor Vehicle Safety, to issue Federal Motor Vehicle Safety Standards (FMVSS) and Regulations to which manufacturers of motor vehicles and items of motor vehicle equipment must conform and certify compliance. Subsequently, other FMVSS have been issued. New standards and amendments to existing standards are published in the Federal Register. These FMVSS are regulations written in terms of minimum safety performance requirements for motor vehicles or items of motor vehicle equipment. These requirements are specified in such a manner that the public is protected against unreasonable risk of crashes occurring as a result of the design, construction, or performance of motor vehicles and is also protected against unreasonable risk of death or injury in the event crashes do occur.	Not known	gen-10	Yes It has been integrated in US Legislation	Safety	Automotive	The Standard dermines some minimum safety requirements applicable for the situational Awareness Use Case
ISO 11228-1	Ergonomics - Manual handling - Part 1: Lifting and carrying	ISO 11228-1:2003 specifies recommended limits for manual lifting and carrying while taking into account, respectively, the intensity, the frequency and the duration of the task. ISO 11228:2003 is designed to provide guidance on the assessment of several task variables, allowing the health risks for the working population to be evaluated. ISO 11228-1:2003 applies to manual handling of objects with a mass of 3 kg or more. ISO 11228-1:2003 applies to moderate walking speed, i.e. 0,5 m/s to 1,0 m/sec on a horizontal level surface. ISO 11228-1:2003 does not include holding of objects (without walking), pushing or pulling of objects, lifting with one hand, manual handling while seated, and lifting by two or more people. Holding, pushing and pulling objects will be included in other parts of ISO 11228. ISO 11228-1:2003 is based on an 8 h working day. It does not concern analysis of combined tasks in a shift during a day.	ISO/TC 159 Ergonomics	2003-05-00	No	Ergonomics	Manufacturing / industry	
ISO 11228-2	Ergonomics - Manual handling - Part 2: Pushing and pulling	ISO 11228-2:2007 gives the recommended limits for whole-body pushing and pulling. It provides guidance on the assessment of risk factors considered important to manual pushing and pulling, allowing the health risks for the working population to be evaluated. The recommendations apply to the healthy adult working population and provide reasonable protection to the majority of this population. These guidelines are based on experimental studies of push-pull tasks and associated levels of musculoskeletal loading, discomfort/pain, and endurance/fatigue. ISO 11228-2:2007 is intended to provide information for designers, employers, employees and others involved in the design or redesign of work, tasks, products and work organization.	ISO/TC 159 Ergonomics	2007-04-00	No	Ergonomics	Manufacturing / industry	

ISO 11228-3	Ergonomics - Manual handling - Part 3: Handling of low loads at high frequency	ISO 11228-3:2006 establishes ergonomic recommendations for repetitive work tasks involving the manual handling of low loads at high frequency. It provides guidance on the identification and assessment of risk factors commonly associated with handling low loads at high frequency, thereby allowing evaluation of the related health risks to the working population. The recommendations apply to the adult working population and are intended to give reasonable protection for nearly all healthy adults. Those recommendations concerning health risks and control measures are mainly based on experimental studies regarding musculoskeletal loading, discomfort/pain and endurance/fatigue related to methods of working. ISO 11228-3:2006 is intended to provide information for all those involved in the design or redesign of work, jobs and products.	ISO/TC 159 Ergonomics	2007-04-00	No	Ergonomics	Manufacturing / industry	
EN 1005-5	Safety of machinery - Human physical performance - Part 5: Risk assessment for repetitive handling at high frequency	This European Standard presents guidance to the designer of machinery or its component parts and the writer of type C standards in assessing and controlling health and safety risks due to machine-related repetitive handling at high frequency. This European Standard specifies reference data for action frequency of the upper limbs during machinery operation, and it presents a risk assessment method intended for risk reduction option analysis. This European Standard applies to machinery for professional operation by the healthy adult working population. This European Standard is not applicable for repetitive movements and related risks of the neck, back and lower limbs.	CEN/TC 122 Ergonomie	2007-02-00	No	Ergonomics	Manufacturing / industry	
ISO 11226	Ergonomics - Evaluation of static working postures	This International Standard establishes ergonomic recommendations for different work tasks. This standard provides information to those involved in design, or redesign, of work, jobs and products who are familiar with the basic concepts of ergonomics in general, and working postures in particular. It specifies recommended limits for static working postures without any or only with minimal external force exertion, while taking into account body angles and time aspects. It is designed to provide guidance on the assessment of several task variables, allowing the health risks for the working population to be evaluated. It applies to the adult working population. The recommendations will give reasonable protection for nearly all healthy adults. The recommendations concerning health risks and protection are mainly based on experimental studies regarding the musculoskeletal load, discomfort/pain, and endurance/fatigue related to static working postures.	ISO/TC 159 Ergonomics	2000-12-00	No	Ergonomics	Manufacturing / industry	

ISO 15534-1	Ergonomic design for the safety of machinery - Part 1: Principles for determining the dimensions required for openings for whole-body access into machinery	This part of ISO 15534 specifies the dimensions of openings for whole-body access into machinery as defined in ISO/TR 12100-1 (withdrwan from the market). It provides the dimensions to which the values given in ISO 15534-3 are applicable. Values for additional space requirements are given in annex A. This part of ISO 15534 has been prepared primarily for non-mobile machinery; there may be additional specific requirements for mobile machinery. Dimensions for passages are based on the values for either the 95th or the 99th percentiles of the expected user population. Values for the 99th percentile apply to emergency egress routes. The anthropometric data given in ISO 15534-3 originate from static measurements of nude persons and do not take into account body movements, clothing, equipment, machinery-operating conditions or environmental conditions. This part of ISO 15534 shows how to combine the anthropometric data with suitable allowances to take these factors into account. Situations where people are to be prevented from reaching a hazard are dealt with in ISO 13852.	ISO/TC 159 Ergonomics	2000-02-00	No	Ergonomics	Manufacturing / industry	
ISO 9241-910	Ergonomics of human-system interaction - Part 910: Framework for tactile and haptic interaction	ISO 9241-910:2011 provides a framework for understanding and communicating various aspects of tactile/haptic interaction. It defines terms, describes structures and models, and gives explanations related to the other parts of the ISO 9241 "900" subseries. It also provides guidance on how various forms of interaction can be applied to a variety of user tasks. It is applicable to all types of interactive systems making use of tactile/haptic devices and interactions. It does not address purely kinaesthetic interactions, such as gestures, although it might be useful for understanding such interactions.	ISO/TC 159 Ergonomics	2011-07-00	No	Ergonomics	Manufacturing / industry	
ISO 9241-110	Ergonomics of human-system interaction - Part 110: Dialogue principles	ISO 9241-110:2006 sets forth ergonomic design principles formulated in general terms (i.e. presented without reference to situations of use, application, environment or technology) and provides a framework for applying those principles to the analysis, design and evaluation of interactive systems. While ISO 9241-110:2006 is applicable to all types of interactive systems, it does not cover the specifics of every context of use (e.g. safety critical systems, collaborative work). It is intended for the following types of users: designers of user interface development tools and style guides to be used by user interface designers; user interface designers, who will apply the guidance during the development process; developers, who will apply the guidance during design and implementation of system functionality; buyers, who will reference it during product procurement; evaluators, who are responsible for ensuring that products meet its recommendations. ISO 9241-110:2006 focuses on dialogue principles related to the ergonomic design of the dialogue between user and interactive system, and does not consider any other aspect of design such as marketing, aesthetics or corporate design.The list of recommendations for each of the dialogue principles is not exhaustive.	ISO/TC 159 Ergonomics	2006-04-00	No	Ergonomics	Manufacturing / industry	

ISO 9241-920	Ergonomics of human-system interaction - Part 920: Guidance on tactile and haptic interactions	ISO 9241-920:2009 gives recommendations for tactile and haptic hardware and software interactions. It provides guidance on the design and evaluation of hardware, software, and combinations of hardware and software interactions, including: the design/use of tactile/haptic inputs, outputs, and/or combinations of inputs and outputs, with general guidance on their design/use as well as on designing/using combinations of tactile and haptic interactions for use in combination with other modalities or as the exclusive mode of interaction; the tactile/haptic encoding of information, including textual data, graphical data and controls; the design of tactile/haptic objects, the layout of tactile/haptic space; interaction techniques. It does not provide recommendations specific to Braille, but can apply to interactions that make use of Braille. The recommendations given in ISO 9241-920:2009 are applicable to at least the controls of a virtual workspace, but they can also be applied to an entire virtual environment — consistent, in as far as possible, with the simulation requirements.	ISO/TC 159 Ergonomics	2009-03-00	No	Ergonomics	Manufacturing / industry	
IEC 60204-1	Safety of machinery - Electrical equipment of machines - Part 1: General requirements	IEC 60204-1:2016 applies to electrical, electronic and programmable electronic equipment and systems to machines not portable by hand while working, including a group of machines working together in a co-ordinated manner. The equipment covered by this part of IEC 60204 commences at the point of connection of the supply to the electrical equipment of the machine. This sixth edition cancels and replaces the fifth edition published in 2005. It constitutes a technical revision. This edition includes the following significant technical changes with respect to the previous edition: added requirements to address applications involving power drive systems (PDS); revised electromagnetic compatibility (EMC) requirements; clarified overcurrent protection requirements; requirements for determination of the short circuit current rating of the electrical equipment; revised protective bonding requirements and terminology; reorganization and revision to Clause 9, including requirements pertaining to safe torque off of PDS, emergency stop, and control circuit protection; revised symbols for actuators of control devices; revised technical documentation requirements; general updating to current special national conditions, normative standards, and bibliographical references.	IEC/TC 44 Electrical equipment of industrial machines	2016-10-00	No	Safety	Manufacturing / industry	
IEC/TR 62899-250	Printed electronics - Part 250: Material technologies required in printed electronics for wearable smart devices	This part of IEC 62899, which is a Technical Report (TR), explores a new technological field to establish standardization activities in TC 119 (Printed electronics) in particular, and to contribute to the development and market expansion of wearable smart device (WSD) technology.	EC/TC 119 Printed Elektronics	2016-12-00	No	Others	Manufacturing / industry	

ISO 8373	Robots and robotic devices - Vocabulary	ISO 8373:2012 defines terms used in relation with robots and robotic devices operating in both industrial and non-industrial environments.	ISO/TC 184 Automation systems and integration	2012-03-00	No	General	Manufacturing / industry	
ISO 9787	Robots and robotic devices - Coordinate systems and motion nomenclatures	ISO 9787:2013 defines and specifies robot coordinate systems. It also provides nomenclature, including notations, for the basic robot motions. It is intended to aid in robot alignment, testing, and programming. ISO 9787:2013 applies to all robots and robotic devices as defined in ISO 8373.	ISO/TC 184 Automation systems and integration	2013-05-00	No	Environment	Manufacturing / industry	
ISO 9946	Manipulating industrial robots - Presentation of characteristics	This International Standard specifies how characteristics of robots shall be presented by the manufacturer.	ISO/TC 184 Automation systems and integration	1999-04-00	No	General	Manufacturing / industry	

ISO 14539	Manipulating industrial robots - Object handling with grasp-type grippers - Vocabulary and presentation of characteristics	This International Standard focuses on the functionalities of end effectors and concentrates on grasp-type grippers as defined in 4.1.2.1. This International Standard provides terms to describe object handling and terms of functions, structures, and elements of grasp-type grippers. Annex A, which is informative, provides formats for presenting characteristics of grasp-type grippers. This part can be used in the following ways: a) End effector manufacturers can present the characteristics of their products to robot users, b) Robot users can specify the requirements of end effectors they need, c) Robot users can describe the characteristics of the objects to be handled and of handling the objects in their specific robot applications. This International Standard is also applicable to simple handling systems which are not covered by the definition of manipulating industrial robots, such as pick-and-place or master-slave units.	ISO/TC 184 Automation systems and integration	2000-11-00	No	General	Manufacturing / industry	
ISO/IEC 30113-1	Information technology - User interface - Gesture-based interfaces across devices and methods - Part 1: Framework	ISO/IEC 30113-1:2015 defines a framework and guidelines for gesture-based interfaces across devices and methods in supporting interoperability. Some of these devices include mice, touch screens, touch pads, 3D mice, joysticks, game controllers, wired gloves, depth-aware cameras, stereo cameras, Web cameras. ISO/IEC 30113-1:2015 does not define or require specific technology for recognizing gesture of users. It focuses on the description of a gesture and its functions for utilizing ICT systems. Operation of a physical keyboard is not addressed in this part of ISO/IEC 30113.	ISO/IEC JTC 1/SC 35 User interfaces	2015-04-00	No	ICT	Manufacturing / industry	
ISO/IEC 30113-11	Information technology - Gesture-based interfaces across devices and methods - Part 11: Single-point gestures for common system actions	ISO/IEC 30113-11:2017 defines single-point gestures for common system actions used in information and communication technology (ICT) systems. It specifies movements for clear and classified gestures recognized by the systems and applications. The single-point gestures are performed using an input device (e.g. a mouse, a stylus, etc.) or a body part (e.g. a fingertip, a hand, etc.). These single-point gestures are intended to operate in a consistent manner regardless of the system, platform, application or device. ICT systems include, but are not limited to, digital televisions, set-top boxes, video game consoles, communication devices, Internet devices, entertainment devices and personal computers.	ISO/IEC JTC 1/SC 35 User interfaces	2017-08-00	No	ICT	Manufacturing / industry	
ITU-T E.333	Man-machine interface	This Recommendation describes how interactions should take place between the user and the system from a logical viewpoint.	ITU Study Group 1 - Service definition	1988-00-00	No	ICT	Manufacturing / industry	

ITU-T Y.4106 (new number ITU-T F.747.3)	Requirements and functional model for a ubiquitous network robot platform that supports ubiquitous sensor network applications and services	The objective of this recommendation is to define a ubiquitous network robot platform, and to identify its requirements and functional model. The use of standard interfaces for the ubiquitous network robot platform will ensure network robot service reusability, portability across several network robot services, and network accessibility and interoperability by the ubiquitous sensor network (USN). The scope of this Recommendation includes: the concept of ubiquitous network robot platform; requirements of the ubiquitous network robot platform; functional model of the ubiquitous network robot platform.	ITU International Telecommunication Union	2013-03-00	No	ICT	Manufacturing / industry	
IEEE 1872	IEEE Standard Ontologies for Robotics and Automation	A core ontology that specifies the main, most general concepts, relations, and axioms of robotics and automation (R&A) is defined in this standard, which is intended as a reference for knowledge representation and reasoning in robots, as well as a formal reference vocabulary for communicating knowledge about R&A between robots and humans. This standard is composedof a core ontology about R&A, called CORA, together with other ontologies that give support to CORA.	IEEE The Institute of Electrical and Electronics Engineers	2015-00-00	No	ICT	Manufacturing / industry	
ISO/TR 20218-1	Robotics - Safety design for industrial robot systems - Part 1: End effectors	This document provides guidance on safety measures for the design and integration of end-effectors used for robot systems. The integration includes the following: the manufacturing, design and integration of end-effectors; the necessary information for use. This document provides additional safety guidance on the integration of robot systems, as described in ISO 10218-2:2011.	ISO/TC 299 Robots and robotic devices	2018-08-00	No	Safety	Manufacturing / industry	
ISO/TS 15066	Robots and robotic devices - Collaborative robots	ISO/TS 15066:2016 specifies safety requirements for collaborative industrial robot systems and the work environment, and supplements the requirements and guidance on collaborative industrial robot operation given in ISO 10218-1 and ISO 10218-2. ISO/TS 15066:2016 applies to industrial robot systems as described in ISO 10218-1 and ISO 10218-2. It does not apply to non-industrial robots, although the safety principles presented can be useful to other areas of robotics. NOTE This Technical Specification does not apply to collaborative applications designed prior to its publication.	ISO/TC 299 Robots and robotic devices	2016-02-00	No	Safety	Manufacturing / industry	Technical specification setting rules for the application of Human Robot Collaboration

ISO/TR 20218-2	Robotics - Safety design for industrial robot systems - Part 2: Manual load/unload stations	ISO/TR 20218-2:2017 is applicable to robot systems for manual load/unload applications in which a hazard zone is safeguarded by preventing access to it. For this type of application, it is important to consider the need for both access restrictions to hazard zones and for ergonomically suitable work places. ISO/TR 20218-2:2017 supplements ISO 10218-2:2011 and provides additional information and guidance on reducing the risk of intrusion into the hazard zones in the design and safeguarding of manual load/unload installations.	ISO/TC 299 Robots and robotic devices	2017-12-00	No	Safety	Manufacturing / industry	
ISO/TR 22100-3	Safety of machinery - Relationship with ISO 12100 - Part 3: Implementation of ergonomic principles in safety standards	ISO/TR 22100-3:2016 describes the main ergonomic risk factors influencing the safety of machinery and gives a framework for incorporating them into the design of machines by the integration of important ergonomic principles relating to: avoiding stressful postures and movements during use of the machine; designing machines, and more especially hand-held and mobile machines, which can be operated easily; avoiding as far as possible noise, vibration, thermal effects.	ISO/TC 199 Safety of machinery	2016-10-00	No	Safety	Manufacturing / industry	
ISO 11161	Safety of machinery - Integrated manufacturing systems - Basic requirements	ISO 11161:2007 specifies the safety requirements for integrated manufacturing systems (IMS) that incorporate two or more interconnected machines for specific applications, such as component manufacturing or assembly. It gives requirements and recommendations for the safe design, safeguarding and information for the use of such IMSs. ISO 11161:2007 is not intended to cover safety aspects of individual machines and equipment that may be covered by standards specific to those machines and equipment. Therefore it deals only with those safety aspects that are important for the safety-relevant interconnection of the machines and components. Where machines and equipment of an integrated manufacturing system are operated separately or individually, and while the protective effects of the safeguards provided for production mode are muted or suspended, the relevant safety standards for these machines and equipment apply.	ISO/TC 199 Safety of machinery	2007-05-00	No	Safety	Manufacturing / industry	
ISO 14118	Safety of machinery - Prevention of unexpected start-up	ISO 14118:2017 specifies requirements for designed-in means aimed at preventing unexpected machine start-up (see 3.2) to allow safe human interventions in danger zones (see Annex A). ISO 14118:2017 applies to unexpected start-up from all types of energy source, i.e.: power supply, e.g. electrical, hydraulic, pneumatic; stored energy due to, e.g. gravity, compressed springs; external influences, e.g. from wind. ISO 14118:2017 does not specify performance levels or safety integrity levels for safety-related parts of control systems. While available means to prevent unexpected start-up are identified, this document does not specify the means for the prevention of unexpected machine start-up for specific machines.	ISO/TC 199 Safety of machinery	2017-12-00	No	Safety	Manufacturing / industry	

ISO/IEC 15408-1:2009	Information technology - Security techniques - Evaluation criteria for IT security - Part 1: Introduction and general model	ISO/IEC 15408-1:2009 establishes the general concepts and principles of IT security evaluation and specifies the general model of evaluation given by various parts of ISO/IEC 15408 which in its entirety is meant to be used as the basis for evaluation of security properties of IT products. It provides an overview of all parts of ISO/IEC 15408. It describes the various parts of ISO/IEC 15408; defines the terms and abbreviations to be used in all parts ISO/IEC 15408; establishes the core concept of a Target of Evaluation (TOE); the evaluation context; and describes the audience to which the evaluation criteria are addressed. An introduction to the basic security concepts necessary for evaluation of IT products is given. It defines the various operations by which the functional and assurance components given in ISO/IEC 15408-2 and ISO/IEC 15408-3 may be tailored through the use of permitted operations. The key concepts of protection profiles (PP), packages of security requirements and the topic of conformance are specified and the consequences of evaluation and evaluation results are described. ISO/IEC 15408-1:2009 gives guidelines for the specification of Security Targets (ST) and provides a description of the organization of components throughout the model. General information about the evaluation methodology is given in ISO/IEC 18045 and the scope of evaluation schemes is provided.	ISO/IEC JTC 1/SC 27 IT Security techniques	2009-12-00	No	ICT	Manufacturing / industry	
ISO/IEC TR 15443-1:2012	Information technology - Security techniques - Security assurance framework - Part 1: Introduction and concepts	ISO/IEC TR 15443-1:2012 defines terms and establishes an extensive and organised set of concepts and their relationships for understanding IT security assurance, thereby establishing a basis for shared understanding of the concepts and principles central to ISO/IEC TR 15443 across its user communities. It provides information fundamental to users of ISO/IEC TR 15443-2.	ISO/IEC JTC 1/SC 27 IT Security techniques	2012-11-00	No	ICT	Manufacturing / industry	
ISO/IEC 18033-1:2015	Information technology - Security techniques - Encryption algorithms - Part 1: General	ISO/IEC 18033-1:2015 is general in nature, and provides definitions that apply in subsequent parts of this International Standard. The nature of encryption is introduced, and certain general aspects of its use and properties are described. The criteria used to select the algorithms specified in subsequent parts of this International Standard are defined in Annexes A and B.	ISO/IEC JTC 1/SC 27 IT Security techniques	2015-08-00	No	ICT	Manufacturing / industry	

ISO/IEC 18045:2008	Information technology - Security techniques - Methodology for IT security evaluation	ISO/IEC 18045:2008 is a companion document to ISO/IEC 15408, Information technology - Security techniques - Evaluation criteria for IT security. ISO/IEC 18045:2008 defines the minimum actions to be performed by an evaluator in order to conduct an ISO/IEC 15408 evaluation, using the criteria and evaluation evidence defined in ISO/IEC 15408. ISO/IEC 18045:2008 does not define evaluator actions for certain high assurance ISO/IEC 15408 components, where there is as yet no generally agreed guidance.	ISO/IEC JTC 1/SC 27 IT Security techniques	2008-08-00	No	ICT	Manufacturing / industry	
ISO/IEC 27000:2018	Information technology - Security techniques - Information security management systems - Overview and vocabulary	ISO/IEC 27000:2018 provides the overview of information security management systems (ISMS). It also provides terms and definitions commonly used in the ISMS family of standards. This document is applicable to all types and sizes of organization (e.g. commercial enterprises, government agencies, not-for-profit organizations). The terms and definitions provided in this document cover commonly used terms and definitions in the ISMS family of standards; do not cover all terms and definitions applied within the ISMS family of standards; and do not limit the ISMS family of standards in defining new terms for use.	ISO/IEC JTC 1/SC 27 IT Security techniques	2018-02-00	No	ICT	Manufacturing / industry	
ISO/IEC 27005:2018	Information technology - Security techniques - Information security risk management	This document provides guidelines for information security risk management. This document supports the general concepts specified in ISO/IEC 27001 and is designed to assist the satisfactory implementation of information security based on a risk management approach. Knowledge of the concepts, models, processes and terminologies described in ISO/IEC 27001 and ISO/IEC 27002 is important for a complete understanding of this document. This document is applicable to all types of organizations (e.g. commercial enterprises, government agencies, non-profit organizations) which intend to manage risks that can compromise the organization's information security.	ISO/IEC JTC 1/SC 27 IT Security techniques	2018-07-00	No	ICT	Manufacturing / industry	
ISO/IEC 27004:2016	Information technology - Security techniques - Information security management - Monitoring, measurement, analysis and evaluation	ISO/IEC 27004:2016 provides guidelines intended to assist organizations in evaluating the information security performance and the effectiveness of an information security management system in order to fulfil the requirements of ISO/IEC 27001:2013, 9.1. It establishes: a) the monitoring and measurement of information security performance; b) the monitoring and measurement of the effectiveness of an information security management system (ISMS) including its processes and controls; c) the analysis and evaluation of the results of monitoring and measurement. ISO/IEC 27004:2016 is applicable to all types and sizes of organizations.	ISO/IEC JTC 1/SC 27 IT Security techniques	2016-12-00	No	ICT	Manufacturing / industry	

ISO/IEC 27032:2012	Information technology - Security techniques - Guidelines for cybersecurity	ISO/IEC 27032:2012 provides guidance for improving the state of Cybersecurity, drawing out the unique aspects of that activity and its dependencies on other security domains, in particular: information security, network security, internet security, and critical information infrastructure protection (CIIP). It covers the baseline security practices for stakeholders in the Cyberspace. This International Standard provides: an overview of Cybersecurity, an explanation of the relationship between Cybersecurity and other types of security, a definition of stakeholders and a description of their roles in Cybersecurity, guidance for addressing common Cybersecurity issues, and a framework to enable stakeholders to collaborate on resolving Cybersecurity issues.	ISO/IEC JTC 1/SC 27 IT Security techniques	2012-07-00	No	ICT	Manufacturing / industry	
EN ISO 10218-1	Robots and robotic devices - Safety requirements for industrial robots - Part 1: Robots (ISO 10218-1:2011)	ISO 10218-1:2011 specifies requirements and guidelines for the inherent safe design, protective measures and information for use of industrial robots. It describes basic hazards associated with robots and provides requirements to eliminate, or adequately reduce, the risks associated with these hazards. ISO 10218-1:2011 does not address the robot as a complete machine. Noise emission is generally not considered a significant hazard of the robot alone, and consequently noise is excluded from the scope of ISO 10218-1:2011. ISO 10218-1:2011 does not apply to non-industrial robots, although the safety principles established in ISO 10218 can be utilized for these other robots.	CEN/TC 310 Advanced Manufacturing Technologies	2011-07-00	Yes: Machinery directive	Safety	Manufacturing / industry	This standard determines the rules for hardware to be adopted in Human Robot Collaboration based application. It does not impact CPSOSAWARE, but it is strongly related to ISO 10218:2
EN ISO 10218-2	Robots and robotic devices - Safety requirements for industrial robots - Part 2: Robot systems and integration (ISO 10218-2:2011)	ISO 10218-2:2011 specifies safety requirements for the integration of industrial robots and industrial robot systems as defined in ISO 10218-1, and industrial robot cell(s). The integration includes the following: the design, manufacturing, installation, operation, maintenance and decommissioning of the industrial robot system or cell; necessary information for the design, manufacturing, installation, operation, maintenance and decommissioning of the industrial robot system or cell; component devices of the industrial robot system or cell. ISO 10218-2:2011 describes the basic hazards and hazardous situations identified with these systems, and provides requirements to eliminate or adequately reduce the risks associated with these hazards. ISO 10218-2:2011 also specifies requirements for the industrial robot system as part of an integrated manufacturing system. ISO 10218-2:2011 does not deal specifically with hazards associated with processes (e.g. laser radiation, ejected chips, welding smoke). Other standards can be applicable to these process hazards.	CEN/TC 310 Advanced Manufacturing Technologies	2011-07-00	Yes: Machinery directive	Safety	Manufacturing / industry	This standard determines the general rules for applications with Human Robot Collaboration in manufacturing. It is setting limiting rules affecting manufacturing application. Reference numerical details for the specific collaborative modes described are in ISO/TS 15066

EN 547-2+A1	Safety of machinery - Human body measurements - Part 2: Principles for determining the dimensions required for access openings	This European Standard specifies the dimensions of openings for access as applied to machinery as defined in EN 292-1. It provides the dimensions to which the values given in EN 547-3 are applicable. Values for additional space requirements are given in annex A. This European Standard has been prepared primarily for non-mobile machinery, there may be additional specific requirements for mobile machinery. Dimensions for access openings are based on the values for the 95 th percentile, whereas reach distances are based on the values for the 5 th percentile, in each case the least favourable body dimension of the expected user population being used as a basis. The same considerations apply to the location of access openings. The anthropometric data given in EN 547-3 originate from static measurements of nude persons and do not take into account body movements, clothing, equipment, machinery operating conditions or environmental conditions. This European Standard shows how to combine the anthropometric data with suitable allowances to take these factors into account. Situations where people are to be prevented from reaching a hazard are dealt with in EN 294.	CEN/TC 122 Ergonomics	2008-09-00	Yes: Machinery directive	Safety	Manufacturing / industry	
EN 547-3+A1	Safety of machinery - Human body measurements - Part 3: Anthropometric data	This European Standard specifies current requirements for human body measurements (anthropometric data) that are required by EN 547-1 and EN 547-2 for the calculation of access opening dimensions as applied to machinery. The anthropometric data originate from static measurements of nude persons and do not take into account body movements, clothing, equipment, machinery operating conditions or environmental conditions. The data are based on information from anthropometric surveys representative of population groups within Europe comprising at least three million people. Both men and women are taken into account. Measurements are given, as required by EN 547-1 and EN 547-2, for the 5 th , 95 th and 99 th percentiles of the relevant population group within Europe.	CEN/TC 122 Ergonomics	2008-09-00	Yes: Machinery directive	Safety	Manufacturing / industry	
EN 614-1+A1	Safety of machinery - Ergonomic design principles - Part 1: Terminology and general principles	This European Standard establishes the ergonomic principles to be followed during the process of design of machinery. This European Standard applies to the interactions between operators and machinery when installing, operating, adjusting, maintaining, cleaning, dismantling, repairing or transporting equipment, and outlines the principles to be followed in taking the health, safety and well-being of the operator into account. This European Standard provides a framework within which the range of more specific ergonomics standards and other related standards relevant to machinery design should be applied. The ergonomic principles given in this European Standard apply to all ranges of human abilities and characteristics to ensure safety, health and well-being and overall system performance. Information will need to be interpreted to suit the intended use. NOTE Although the principles in this European Standard are orientated towards machinery for occupational use, they are also applicable to equipment and machinery for private use.	CEN/TC 122 Ergonomics	2009-02-00	Yes: Machinery directive	Ergonomics	Manufacturing / industry	

EN 614-2+A1	Safety of machinery - Ergonomic design principles - Part 2: Interactions between the design of machinery and work tasks	This European Standard establishes the ergonomics principles and procedures to be followed during the design process of machinery and operator work tasks. This European Standard deals specifically with task design in the context of machinery design, but the principles and methods may also be applied to job design. This European Standard is directed to designers and manufacturers of machinery and other work equipment. It will also be helpful to those who are concerned with the use of machinery and work equipment, e. g. to managers, organizers, operators and supervisors. In this European Standard the designer refers to the person or group of persons responsible for the design.	CEN/TC 122 Ergonomics	2008-09-00	Yes: Machinery directive	Safety	Manufacturing / industry	
EN 842+A1	Safety of machinery - Visual danger signals - General requirements, design and testing	This European Standard describes criteria for the perception of visual danger signals in the area that people are intended to perceive and to react to such a signal. It specifies the safety and ergonomic requirements and the corresponding physical measurements and subjective visual check. It also provides guidance for the design of the signals to be clearly perceived and differentiated as described in 5.3 of EN 292-2:1991. This European Standard does not apply to danger indicators: Presented in either written or pictorial form; Transmitted by data display units. This European Standard does not apply to special regulations such as those for public disaster and public transport.	CEN/TC 122 Ergonomics	2008-09-00	Yes: Machinery directive	Safety	Manufacturing / industry	
EN 894-1+A1	Safety of machinery - Ergonomics requirements for the design of displays and control actuators - Part 1: General principles for human interactions with displays and control actuators	This European Standard applies to the design of displays and control actuators on machinery. It specifies general principles for human interaction with displays and control actuators, to minimise operator errors and to ensure an efficient interaction between the operator and the equipment. It is particularly important to observe these principles when an operator error may lead to injury or damage to health.	CEN/TC 122 Ergonomics	2008-10-00	Yes: Machinery directive	Safety	Manufacturing / industry	
EN 894-2+A1	Safety of machinery - Ergonomics requirements for the design of displays and control actuators - Part 2: Displays	This European Standard gives guidance on the selection, design and location of displays to avoid potential ergonomic hazards associated with their use. It specifies ergonomics requirements and covers visual, audible and tactile displays. It applies to displays used in machinery (e. g. devices and installations, control panels, operating and monitoring consoles) for occupational and private use. Specific ergonomics requirements for visual display terminals (VDTs) used for office tasks are given in the standard EN ISO 9241.	CEN/TC 122 Ergonomics	2008-10-00	Yes: Machinery directive	Safety	Manufacturing / industry	
EN 894-3+A1	Safety of machinery - Ergonomics requirements for the design of displays and control actuators - Part 3: Control actuators	This European Standard gives guidance on the selection, design and location of control actuators so that they are adapted to the requirements of the operators, are suitable for the control task in question and take account of the circumstances of their use. It applies to manual control actuators used in equipment for occupational and private use. It is particularly important to observe the recommendations in this European Standard where operating a control actuator may lead to injury or damage to health, either directly or as a result of a human error.	CEN/TC 122 Ergonomics	2008-10-00	Yes: Machinery directive	Safety	Manufacturing / industry	

EN 894-4	Safety of machinery - Ergonomics requirements for the design of displays and control actuators - Part 4: Location and arrangement of displays and control actuators	This European Standard contains ergonomic requirements for the location and arrangement of displays and control actuators in order to avoid hazards associated with their use. This European Standard applies to displays and control actuators for machinery and other interactive equipment (e. g. devices and installations, instrument panels, control and monitoring consoles). This European Standard is not applicable to the location and arrangement of displays and control actuators which are manufactured before the date of its publication as EN.	CEN/TC 122 Ergonomics	2010-06-00	Yes: Machinery directive	Safety	Manufacturing / industry	
EN 981+A1	Safety of machinery - System of auditory and visual danger and information signals	To reduce risks associated with misinterpretation of visual and auditory danger signals, a system of danger and information signals is specified taking into account the different degrees of urgency. This European Standard is applicable to all danger and information signals which have to be clearly perceived and differentiated as specified in 5.3 of EN 292-2:1991, by other requirements or by the work situation, and to all degrees of urgency - from extreme urgency to an ALL CLEAR situation. Where visual signals are to be complementary to sound signals, the signal character is specified for both. This European Standard does not apply to certain fields covered by specific standards or other conventions in force (international or national); in particular, fire alarms, medical alarms, alarms used in the field of public transport, navigation signals and signals for special fields of activity (for example, military). When new signals are being planned, however, this European Standard should be considered in order to avoid inconsistency. For auditory signals, the system of signal character is a guideline for a signal language based on message categories which are classified according to urgency. Certain characters are specified for purposes which require safe and rapid recognition. Certain categories allow possibilities for variants, e. g. control and warning signals at workplaces where the signalling is intended for personnel with specific training. For visual signals, the established meanings of the safety colours are not affected by this European Standard. For different needs, complementary meanings have been assigned to the signals by timed patterns, and in a very few cases by alternating colours.	CEN/TC 122 Ergonomics	2008-09-00	Yes: Machinery directive	Safety	Manufacturing / industry	
EN 1005-1+A1	Safety of machinery - Human physical performance - Part 1: Terms and definitions	This European Standard provides terms and definitions on concepts and parameters used for EN 1005-21, prEN 1005-3, EN 1005-4 and EN 1005-5. Basic concepts and general ergonomic principles for the design of machinery are dealt with in EN 292-1, EN 292-2 and EN 614-1. This document is not applicable to specify the machinery which is manufactured before the date of publication of this document by CEN.	CEN/TC 122 Ergonomics	2008-10-00	Yes: Machinery directive	Safety	Manufacturing / industry	

EN 1005-2+A1	Safety of machinery - Human physical performance - Part 2: Manual handling of machinery and component parts of machinery	This European Standard specifies ergonomic recommendations for the design of machinery involving manual handling of machinery and component parts of machinery, including tools linked to the machine, in professional and domestic applications. This European Standard applies to the manual handling of machinery, component parts of machinery and objects processed by the machine (input/output) of 3 kg or more, for carrying less than 2 m. Objects of less than 3 kg are dealt with in prEN 1005-51). The standard provides data for ergonomic design and risk assessment concerning lifting, lowering and carrying in relation to the assembly/erection, transport and commissioning (assembly, installation, adjustment), operation, fault finding, maintenance, setting, teaching or process changeover and decommissioning, disposal and dismantling of machinery. This standard provides current data on the general population and certain sub-populations (clarified in annex A). This part of the standard does not cover the holding of objects (without walking), pushing or pulling of objects, hand-held machines, or handling while seated. This document is not applicable to specify the machinery which are manufactured before the date of publication of this document by CEN.	CEN/TC 122 Ergonomics	2008-10-00	Yes: Machinery directive	Safety	Manufacturing / industry	
EN 1005-3+A1	Safety of machinery - Human physical performance - Part 3: Recommended force limits for machinery operation	This European Standard presents guidance to the manufacturer of machinery or its component parts and the writer of C-standards in controlling health risks due to machine-related muscular force exertion. This standard specifies recommended force limits for actions during machinery operation including construction, transport and commissioning (assembly, installation, adjustment), use (operation, cleaning, fault finding, maintenance, setting, teaching or process changeover) decommissioning, disposal and dismantling. The standard applies primarily to machines which are manufactured after the date of issue of the standard. This standard applies on one hand to machinery for professional use operated by the adult working population, who are healthy workers with ordinary physical capacity, and on the other hand to machinery for domestic use operated by the whole population including youth and old people. The recommendations are derived from research on European population. This document is not applicable to specify the machinery which are manufactured before the date of publication of this document by CEN.	CEN/TC 122 Ergonomics	2008-10-00	Yes: Machinery directive	Safety	Manufacturing / industry	

EN 1005-4+A1	Safety of machinery - Human physical performance - Part 4: Evaluation of working postures and movements in relation to machinery	This European Standard presents guidance when designing machinery or its component parts in assessing and affecting health risks due only to machine-related postures and movements, i.e. during assembly, installation, operation, adjustment, maintenance, cleaning, repair, transport, and dismantlement. This European Standard specifies requirements for postures and movements without any or with only minimal external force exertion. The requirements are intended to reduce the health risks for nearly all healthy adults. This European Standard is not applicable to the machinery, which is manufactured before the date of publication of this European Standard by CEN.	CEN/TC 122 Ergonomics	2008-10-00	Yes: Machinery directive	Safety	Manufacturing / industry	
EN ISO 14738	Safety of machinery - Anthropometric requirements for the design of workstations at machinery (ISO 14738:2002, including Cor 1:2003 and Cor 2:2005)	This International Standard establishes principles for deriving dimensions from anthropometric measurements and applying them to the design of workstations at non-mobile machinery. It is based on current ergonomic knowledge and anthropometric measurements.This International Standard specifies the body's space requirements for equipment during normal operation in sitting and standing positions. This International Standard does not specifically include space demands for maintenance, repairing and cleaning work.This International Standard does not give recommendations specifically for visual display terminal workstations at machinery. For this purpose ISO 9241-5 can be used in conjunction with this International Standard. Situations where people are to be prevented from reaching a hazard are dealt with in ISO 13852.	CEN/TC 122 Ergonomics	2008-09-00	Yes: Machinery directive	Safety	Manufacturing / industry	
EN ISO 15536-1	Ergonomics - Computer manikins and body templates - Part 1: General requirements (ISO 15536-1:2005)	ISO 15536-1:2005 establishes the general requirements for the design and development of computer manikins, body templates and manikin systems. It addresses their anthropometric and biomechanical properties, taking into account their usability and restrictions for structural complexity and functional versatility, and is also intended as a guide for the selection of manikins and manikin systems and for the evaluation of their accuracy and usability for the specified use. It specifies the documentation of the characteristics of manikins and manikin systems and their intended use, for the guidance of their users. It provides means for ensuring that computer manikins and body templates for the design of work space are appropriately accurate and reliable in their anthropometric and biomechanical aspects. It aims to ensure that users of manikins are able to choose an appropriate manikin system for particular design tasks and use it in an appropriate way. It sets requirements only on the static accuracy of the manikin, but provides recommendations on the other factors that can influence the accuracy of the analyses and determinations performed using them.	CEN/TC 122 Ergonomics	2008-09-00	Yes: Machinery directive	Ergonomics	Manufacturing / industry	

EN ISO 13732-1	Ergonomics of the thermal environment - Methods for the assessment of human responses to contact with surfaces - Part 1: Hot surfaces (ISO 13732-1:2006)	ISO 15536-1:2006 provides temperature threshold values for burns that occur when human skin is in contact with a hot solid surface. It also describes methods for the assessment of the risks of burning, when humans could or might touch hot surfaces with their unprotected skin. In addition, ISO 13732-1:2006 gives guidance for cases where it is necessary to specify temperature limit values for hot surfaces, but does not set surface temperature limit values. ISO 13732-1:2006 deals with contact periods of 0,5 s and longer. It is applicable to contact when the surface temperature is essentially maintained during the contact. It is not applicable if a large area of the skin (approximately 10 % or more of the skin of the whole body) can be in contact with the hot surface. Neither does it apply to skin contact of more than 10 % of the head or contact which could result in burns of vital areas of the face. ISO 13732-1:2006 is applicable to the hot surfaces of all kind of objects: equipment, products, buildings, natural objects, etc. It is applicable to hot surfaces of products that may be touched by healthy adults, children, elderly people and also by people with physical disabilities. For the purposes of simplification, it mentions only products; nevertheless, it applies to all other objects as well. It is applicable to products used in any environment, e.g. in the workplace, in the home. It does not provide data for the protection against discomfort or pain.	CEN/TC 122 Ergonomics	2008-09-00	Yes: Machinery directive	Ergonomics	Manufacturing / industry	
EN ISO 13732-3	Ergonomics of the thermal environment - Methods for the assessment of human responses to contact with surfaces - Part 3: Cold surfaces (ISO 13732-3:2005)	ISO 13732-3:2005 provides methods for the assessment of the risk of cold injury and other adverse effects when a cold surface is touched by bare-hand/finger skin. It provides ergonomics data for establishing temperature limit values for cold solid surfaces. The values established can be used in the development of special standards, where surface temperature limit values are required. Its data are applicable to all fields where cold solid surfaces cause a risk of acute effects: pain, numbness and frostbite, and are not limited to the hands but can be applied in general to the healthy human skin of male and female adults.	CEN/TC 122 Ergonomics	2008-09-00	Yes: Machinery directive	Ergonomics	Manufacturing / industry	
EN 1837+A1	Safety of machinery - Integral lighting of machines	This standard specifies the parameters of integral lighting systems designed to provide illumination in and/or at both stationary and mobile machines to enable the safe use of the machine and the efficient performance of the visual task within and/or at the machine to be carried out. This standard does not specify lighting systems mounted on the machine to specifically illuminate visual tasks outside the machine. The function and requirements of these systems are specified in the European Standard dealing with the lighting of work places. This European Standard is under preparation. This standard does not establish additional requirements for the operation of lighting systems in severe conditions (extreme environmental conditions such as freezer applications, high temperatures, etc.); subject to special rules (e. g. explosive atmospheres); where the transmittance is reduced by environmental conditions, such as smoke, splashing, etc.	CEN/TC 169 Light and lighting	2009-09-00	Yes: Machinery directive	Safety	Manufacturing / industry	

EN ISO 12100	Safety of machinery - General principles for design - Risk assessment and risk reduction (ISO 12100:2010)	ISO 12100:2010 specifies basic terminology, principles and a methodology for achieving safety in the design of machinery. It specifies principles of risk assessment and risk reduction to help designers in achieving this objective. These principles are based on knowledge and experience of the design, use, incidents, accidents and risks associated with machinery. Procedures are described for identifying hazards and estimating and evaluating risks during relevant phases of the machine life cycle, and for the elimination of hazards or sufficient risk reduction. Guidance is given on the documentation and verification of the risk assessment and risk reduction process. ISO 12100:2010 is also intended to be used as a basis for the preparation of type-B or type-C safety standards. It does not deal with risk and/or damage to domestic animals, property or the environment.	CEN/TC 114 Safety of machinery	2010-11-00	Yes: Machinery directive	Safety	Manufacturing / industry	
EN ISO 13849-1	Safety of machinery - Safety-related parts of control systems - Part 1: General principles for design (ISO 13849-1:2015)	ISO 13849-1:2015 provides safety requirements and guidance on the principles for the design and integration of safety-related parts of control systems (SRP/CS), including the design of software. For these parts of SRP/CS, it specifies characteristics that include the performance level required for carrying out safety functions. It applies to SRP/CS for high demand and continuous mode, regardless of the type of technology and energy used (electrical, hydraulic, pneumatic, mechanical, etc.), for all kinds of machinery. It does not specify the safety functions or performance levels that are to be used in a particular case. This part of ISO 13849 provides specific requirements for SRP/CS using programmable electronic system(s). It does not give specific requirements for the design of products which are parts of SRP/CS. Nevertheless, the principles given, such as categories or performance levels, can be used.	CEN/TC 114 Safety of machinery	2015-12-00	Yes: Machinery directive	Safety	Manufacturing / industry	
EN ISO 13849-2	Safety of machinery - Safety-related parts of control systems - Part 2: Validation (ISO 13849-2:2012)	ISO 13849-2:2012 specifies the procedures and conditions to be followed for the validation by analysis and testing of the specified safety functions, the category achieved, and the performance level achieved by the safety-related parts of a control system (SRP/CS) designed in accordance with ISO 13849-1.	CEN/TC 114 Safety of machinery	2012-10-00	Yes: Machinery directive	Safety	Manufacturing / industry	
EN ISO 13850	Safety of machinery - Emergency stop function - Principles for design (ISO 13850:2015)	ISO 13850:2015 Standard specifies functional requirements and design principles for the emergency stop function on machinery, independent of the type of energy used. It does not deal with functions such as reversal or limitation of motion, deflection of emissions (e.g. radiation, fluids), shielding, braking or disconnecting, which can be part of the emergency stop function.The requirements for this International Standard apply to all machines, with exception to: machines where an emergency stop would not reduce the risk; hand-held or hand-operated machines.	CEN/TC 114 Safety of machinery	2015-11-00	Yes: Machinery directive	Safety	Manufacturing / industry	

EN ISO 13855	Safety of machinery - Positioning of safeguards with respect to the approach speeds of parts of the human body (ISO 13855:2010)	ISO 13855:2010 establishes the positioning of safeguards with respect to the approach speeds of parts of the human body. It specifies parameters based on values for approach speeds of parts of the human body and provides a methodology to determine the minimum distances to a hazard zone from the detection zone or from actuating devices of safeguards.The values for approach speeds (walking speed and upper limb movement) in ISO 13855:2010 are time tested and proven in practical experience. ISO 13855:2010 gives guidance for typical approaches. Other types of approach, for example running, jumping or falling, are not considered in ISO 13855:2010. Safeguards considered in ISO 13855:2010 include: electro-sensitive protective equipment, including light curtains and light grids (AOPDs), and laser scanners (AOPDDRs) and two-dimensional vision systems; pressure-sensitive protective equipment, especially pressure-sensitive mats; two-hand control devices; interlocking guards without guard locking.	CEN/TC 114 Safety of machinery	2010-05-00	Yes: Machinery directive	Safety	Manufacturing / industry	
EN ISO 13857	Safety of machinery - Safety distances to prevent hazard zones being reached by upper and lower limbs (ISO 13857:2008)	ISO 13857:2007 establishes values for safety distances in both industrial and non-industrial environments to prevent machinery hazard zones being reached. The safety distances are appropriate for protective structures. It also gives information about distances to impede free access by the lower limbs. It covers people of 14 years and older (the 5th percentile stature of 14 year olds is approximately 1 400 mm). In addition, for upper limbs only, it provides information for children older than 3 years (5th percentile stature of 3 year olds is approximately 900 mm) where reaching through openings needs to be addressed.	CEN/TC 114 Safety of machinery	2008-03-00	Yes: Machinery directive	Safety	Manufacturing / industry	
EN 349+A1	Safety of machinery - Minimum gaps to avoid crushing of parts of the human body	The object of this European Standard is to enable the user (e. g. standard makers, designers of machinery) to avoid hazards from crushing zones. It specifies minimum gaps relative to parts of the human body and is applicable when adequate safety can be achieved by this method. This European Standard is applicable to risks from crushing hazards only and is not applicable to other possible hazards, e. g. impact, shearing, drawing-in. NOTE For e. g. impact, shearing, drawing-in hazards, additional or other measures need to be taken	CEN/TC 114 Safety of machinery	2008-06-00	Yes: Machinery directive	Safety	Manufacturing / industry	

EN 574+A1	Safety of machinery - Two-hand control devices - Functional aspects - Principles for design	This standard specifies the safety requirements of a two-hand control device and its logic unit as defined in 3.1. This standard describes the main characteristics of two-hand control devices for the achievement of safety and sets out combinations of functional characteristics for three types. This standard does not apply to devices intended to be used as enabling devices, hold to run devices and as special control devices. This standard does not specify with which machines two-hand control devices shall be used. It also does not specify which types of two-hand-control device shall be used. Moreover it does not specify the distance between the two-hand control device and the danger zone (see 9.8). The standard provides requirements and guidance on the design and selection (based on a risk assessment) of two-hand control devices including their assessment, the prevention of defeat and the avoidance of faults. The standard also provides requirements and guidance for two-hand control devices containing a programmable electronic system (see 7). This standard applies to all two-hand control devices, independent of the energy used, including: Two-hand control devices which are or are not integral parts of a machine; Two-hand control devices which consist of one or more than one separate elements.	CEN/TC 114 Safety of machinery	2008-06-00	Yes: Machinery directive	Safety	Manufacturing / industry	
EN 61310-3	Safety of machinery - Indication, marking and actuation - Part 3: Requirements for the location and operation of actuators (IEC 61310-3:2007)	Specifies safety-related requirements for actuators, operated by the hand or by other parts of the human body, at the human-machine interface. It gives general requirements for the standard direction of movement for actuators; the arrangement of an actuator in relation to other actuators; the correlation between an action and its final effects. It includes the following significant technical changes with respect to the previous edition: Table 1, Table 2 and Table A.1 have been revised editorially.	CLC/TC 44X Safety of machinery - Electrotechnical aspects	2008-02-00	Yes: Machinery directive	Safety	Manufacturing / industry	
EN 62061	Safety of machinery - Functional safety of safety-related electrical, electronic and programmable electronic control systems (IEC 62061:2005/A2:2015)	Specifies requirements and makes recommendations for the design, integration and validation of safety-related electrical, electronic and programmable electronic control systems (SRECS) for machines. It is applicable to control systems used, either singly or in combination, to carry out safety-related control functions on machines that are not portable by hand while working, including a group of machines working together in a co-ordinated manner.	CLC/TC 44X Safety of machinery - Electrotechnical	2015-08-00	Yes: Machinery directive	Safety	Manufacturing / industry	

ISO/TR 7250-1	Basic human body measurements for technological design — Part 1: Body measurement definitions and landmarks	ISO 7250-1:2017 provides a description of anthropometric measurements which can be used as a basis for comparison of population groups and for the creation of anthropometric databases (see ISO 15535). The basic list of measurements specified in this document is intended to serve as a guide for ergonomists who are required to define population groups and apply their knowledge to the geometric design of the places where people work and live. In addition, the list serves as a basis for extracting one- and two-dimensional measurements from three-dimensional scans (specified in ISO 20685). It serves as a guide on how to take anthropometric measurements, but also gives information to the ergonomist and designer on the anatomical and anthropometrical bases and principles of measurement which are applied in the solution of design tasks. ISO 7250-1:2017 is intended to be used in conjunction with national or international regulations or agreements to ensure harmony in defining population groups and to allow comparison of anthropometric data among member bodies. In its various applications, it is anticipated that the basic list will be supplemented by specific additional measurements. Annex A shows the correspondence of dimensions described here with their use in ISO 14738 and ISO 15534.	ISO/TC 159/SC 3	2017-08	No	Ergonomics	Manufacturing / industry	
ISO/TR 7250-2	Basic human body measurements for technological design — Part 2: Statistical summaries of body measurements from national populations	ISO/TR 7250-2:2010 provides statistical summaries of body measurements together with database background information for working age people in the national populations of individual ISO member bodies. The data are intended for use in conjunction with ISO standards for equipment design and safety, which require body measurement input, wherever national specificity of design parameters is required.	ISO/TC 159/SC 3	2010-02	No	Ergonomics	Manufacturing / industry	
ISO/TR 7250-3	Basic human body measurements for technological design — Part 3: Worldwide and regional design ranges for use in product standards	ISO 7250-3:2015 provides worldwide and regional tables of design ranges for use with product standards for equipment design and safety that require ISO 7250 body measurement data input.	ISO/TC 159/SC 3	2015-08	No	Ergonomics	Manufacturing / industry	
IEEE 802.11p - DSRC	A part of to the IEEE 802.11 standard related to wireless access in vehicular environments (WAVE), a vehicular communication system.	Dedicated Short Range Communication (DSRC) was introduced in the IEEE 802.11p, a variant of the original WiFi standard. The 75MHz band of 6GHz spectrum (5.85 to 5.925 GHz) was allocated to DSRC-capable devices	IEEE The Institute of Electrical and Electronics Engineers	15/07/2010	Yes : V2X Simulation	Communication	Automotive	Affects the V2X Simulation module

3GPP C-V2X	The 3rd Generation Partnership Project (3GPP) is an umbrella term for a number of standards organizations which develop protocols for mobile telecommunications. The part mentioned in this document is related to Cellular Vehicle-to-everything networks	Cellular V2X (C-V2X) is a 3GPP standard for V2X applications such as self-driving cars and ADAS systems. It is an alternative to 802.11p, the IEEE specified standard for V2V and other forms of V2X communications.	The 3rd Generation Partnership Project (3GPP)	2014-2017	Yes : V2X Simulation	Communication	Automotive	Affects the V2X Simulation module

6.2 Annex 2 – compilation of survey "Code of Practice for Researchers on Standardization"

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Code of Practice for Researchers on Standardisation

Fields marked with * are mandatory.

1 Introduction

Dear Project beneficiary,

As part of the implementation of the Communication on 'A new ERA for Research and Innovation' DG Research and Innovation (DG R&I) is developing Guiding Principles for knowledge valorisation as set out by Action 7 of the Communication. A set of codes of practice have been proposed in order to implement these Guiding Principles. One of these codes of practice will be a Code of Practice for researchers on standardisation. This code will be co-created with relevant stakeholders to ensure its usefulness, relevance and create ownership. As part of this exercise, DG R&I is launching a comprehensive on-line survey to collect and understand the experiences and views of beneficiaries on the role of standardisation in valorising R&I results.
By investigating the nature and the extent to which Horizon 2020 projects have made use of standards or have proposed or contributed to the development of new standards as part of their activities, the survey will provide important input to the code of practice on standardisation.
Following the analyses of project data of Horizon 2020, your project has been selected as relevant for standardisation as means of valorisation of R&I results. In order to facilitate the design of the code, DG R&I would appreciate if you could contribute to this work by responding the survey questionnaire. If your project is ongoing, please respond to the survey in relation to your expectations for the project as a whole. Bearing in mind the specificities of some questions you may deem it necessary to involve project partners.
Responses should be completed before 31 May 2021.

Your answers will be saved automatically as you enter them. All individual responses will be treated as confidential and will not be reported in an attributable format without your permission.

2 About your organisation and consortium

*2.1 Please indicate the number of your project.

871738

*2.2 What type of organisation is the project coordinated by?

- ○ University
- ◉ Research and Technology Organisation
- ○ Company other than SME
- ○ SME
- ○ National standardisation body (NSB) or standard development organisation (SDO)
- ○ Other

*2.4 What kind of organisations is the consortium composed of? Multiple indication is possible.

- ☑ University
- ☑ Research and Technology Organisation
- ☑ Company other than SME
- ☑ SME
- ☐ National standardisation body (NSB) or standard development organisation (SDO)
- ☐ Other

*2.6 In which countries are the consortium members of your project located? Multiple indication is possible.

☐ Austria	☑ Germany	☑ Poland
☐ Belgium	☑ Greece	☐ Portugal
☐ Bulgaria	☐ Hungary	☐ Romania
☐ Croatia	☐ Ireland	☐ Slovakia
☑ Republic of Cyprus	☑ Italy	☐ Slovenia
☐ Czech Republic	☐ Latvia	☑ Spain
☐ Denmark	☐ Lithuania	☐ Sweden
☐ Estonia	☐ Luxembourg	☑ Associated country
☑ Finland	☐ Malta	☐ Other
☐ France	☐ Netherlands	

2.7 Please specify:

Israel

3 About your project

*3.1 Under which thematic section of Horizon 2020 has your project been funded?

- ○ Marie Sklodowska-Curie Actions
- ○ Research infrastructures
- ○ Leadership in Enabling Industrial Technologies
- ○ Nanotechnologies, Advanced Materials, Advanced Manufacturing and Processing and Biotechnology
- ◉ Information and Communication Technologies
- ○ Access to Risk Finance
- ○ Innovation in SMEs
- ○ Health, Demographic Change and Wellbeing
- ○ Food Security, Sustainable Agriculture and Forestry, Marine, Maritime and Inland Water Research and the Bioeconomy
- ○ Secure, Clean and Efficient Energy
- ○ Smart, Green and Integrated Transport
- ○ Climate Action, Environment, Resource Efficiency and Raw Materials
- ○ Europe in a changing world – Inclusive, innovative and reflective societies
- ○ Secure societies
- ○ Spreading Excellence and Widening Participation
- ○ Enhanced European Innovation Council Pilot (FET, SME Instrument, Pathfinder, Accelerator)
- ○ Euratom
- ○ Science with and for Society

*3.2 In which domain has your project been running?

- ○ Agriculture and forestry
- ○ Bio-based industries, biodiveristy
- ○ Biotechnology
- ○ Construction Energy
- ○ Circular economy
- ○ Food, fisheries and healthy diet
- ○ Health
- ◉ ICT including digital transformation
- ○ Key Enabling technologies
- ○ Raw materials
- ○ Security
- ○ Space
- ○ Transport
- ○ Water resources
- ○ Water, air and soil quality
- ○ Other

*3.4 Under what type of action has your project been funded?

- ◉ Research and Innovation action
- ○ Innovation Action
- ○ Coordination and support action
- ○ Marie Sklodowska-Curie action
- ○ European Research Council (ERC)
- ○ ERA-NET Cofund
- ○ Pre-commercial Procurement (PCP)
- ○ Public Procurement of Innovative Solutions (PPI)
- ○ SME instrument, EIC pilot

3.5 Which level of readiness describes your technology at the start and at the end of your project?

	At the start	At the end
TRL 1 – basic principles observed	☐	☐
TRL 2 – technology concept formulated	☐	☐
TRL 3 – experimental proof of concept	☑	☐
TRL 4 – technology validated in lab	☐	☐
TRL 5 – technology validated in relevant environment	☐	☑
TRL 6 – technology demonstrated in relevant environment	☐	☐
TRL 7 – system prototype demonstration in operational environment	☐	☐
TRL 8 – system complete and qualified	☐	☐
TRL 9 – actual system proven in operational environment	☐	☐

*3.6 Has your project delivered new services and/or products on the market during the project or beyond the end date?

- ◉ Yes
- ○ No

3.7 If yes, which ones:

Novel Cooperative Odometers for C-ITS systems, VR tools for lifelong learning processes in manufacturing sites

4 About the collaboration with standards development organisations

A National Standardization Body (NSB) is a one stop shop for all stakeholders and is the main focal point of access to the concerted standardisation system. Besides the NSB Standard Developing Organisations (SDOs) focus on developing, publishing, or disseminating technical standards using a consensus-based standards development process. SDOs are any official organisation that can provide the infrastructure for developing standards in compliance with the same procedures the NSB uses. A Technical Committee (TC) is a group responsible for the development and drafting of standards which are then ratified by European Standards Organisations.

4.1 Has your project liaised with standards developing organisation (SDO), national standardisation body (NSB) or technical committee (TC)?

	Yes	No
* SDO	◉	○
* NSB	○	◉
* TC	○	◉

4.2 If yes, which ones?

IEEE P2020
UNI EN ISO 10218-1, 10218-2
ISO/TS 15066
ISO 11226
ISO 11228
UNI EN ISO 7250
ISO 1005-1, 1005-2, 1005-3, 1005-4, 1005-5

4.3 At what stage did you liaise wizh SDOs, NSBs or TCs? What did you expect from the collaboration?

To integrate knowledge from the standard inside the project and communicate/ standardize our outcomes

*4.4 Have there been a SDO, SNB or TA directly involved in the conortium?

- ○ Yes
- ◉ No

4.5 How did you choose cooperation with the SDO, NSB or TCs?

4.6 How did the SDO, NSB or TC contribute to the methodology of the work package relevant for standardisation?

*4.7 Did the implication of the SDO or NSB impact technological choices in any way?

- Yes
- No

*4.9 Have you been in collaboration with SDOs or NSBs outside the project?

- Yes
- No

4.10 If yes, which ones:

SDOs, NSBs and TCs

*4.11 To what extent was the external standardisation entity involved in the project?

- Not involved
- Very little involved
- Little involved
- Somewhat involved
- Highly involved

4.12 Has the SDO / NSB / TC been invoved as:

- Directly partner
- Third party
- Advisory body

4.13 Have you had any contact with CEN-CENELEC or ETSI?

	Yes	No
* CEN-CENELEC	○	●
* ETSI	○	●

4.15 If other, please specify

4.16 If yes, what have been the main differences in terms of collaboration if you compare with collaboration European standardisation organisations?

5 About addressing standardisation in your project

*5.1 How important do you consider standardisation in your project?

- Of no importance
- Of little importance
- Of some importance
- Of major importance

*5.2 In your project standardisation activities have been addressed:

- In a dedicated work-package
- In a dedicated task
- As a transversal issue in different work packages
- As a transversal issue in different tasks
- Other (e.g. by setting-up an Advisory Group)

*5.3 Did the consortium members advocate for the incorporation of standardisation activities in the project?

- Not at all
- Little bit
- Somewhat
- Strongly

*5.4 Were any of the consortium members against implementing standardisation activities?

- Not at all
- Little bit
- Somewhat
- Strongly

5.5 What were the main initial reasons for addressing standardisation in your project? Multiple indication is possible.

- [x] Standardisation was a requirement from the market.
- [x] It was a requirement from the legislation
- [x] It was a requirement from your organisation
- [ ] It was a key requirement of the call for projects
- [x] It was seen as critical to conduct the research activities during the projects (e.g. for agreeing on terminology or methodology)
- [ ] It was seen as critical to ensure the success of the project's exploitation and/or market strategy
- [ ] Other

5.7 When have the standardisation activities been mainly implemented in your project?

- ○ At the beginning of the project
- ○ Throughout the project
- ○ During the final phase of the project
- ◉ Other:

5.8 Were there any risks you encountered in relation to standardisation related acitivites?

there is the risk not to manage to have a contact with standardization bodies or to collect not enough details to justify the request of new standards. The second point would hinder communication with Standardization bodies

5.9 If other, please specify:

beginning and end

5.10 Have the results of the standardisation activities in your project been followed by any specific action after the end of the project?

- ○ Yes
- ◉ No

5.12 Have the standardisation activities in your project led to specific deliverables?

- ◉ Yes
- ○ No

5.13 If yes, what is the nature of these deliverables?

- ☐ Common terminology
- ☐ Harmonised research methodology
- ☐ Recommendations and/or requirements for new or revised standards
- ☐ One of the standardisation tools proposed by the CEN CENELEC
- ☐ Workshop Agreements (CWAs)
- ☐ Technical Specifications
- ☐ Standard Operating Procedure
- ☑ A Technical Report
- ☐ Development of a new standard
- ☐ Proficiency Test
- ☐ Reference data
- ☐ Reference material
- ☐ Certification
- ☐ Accreditation
- ☐ Interlaboratory comparisons
- ☐ Other. Please specify:

5.15 Which standard was addressed by your project?

5.16 What were the overall costs related to standardisation activities?

5.17 Have you encountered specific difficulties or barriers in conducting standardisation activities during the project?

- ○ Yes
- ◉ No

5.19 Have there been any disadvantages of the standardisation process that negatively impacted the project?

- ○ Yes
- ◉ No

5.20 Are technologies that are proposed in standard development exercises also patented or have patents been applied for?

- ○ Yes
- ○ No

6 About exisiting standards

* 6.1 Has your project involved a review or assessment of existing standards to understand if any would have been useful for your project?

- ◉ Yes
- ○ No
- ○ I don't know

* 6.2 Have you identified and made direct use of one or more existing standards as part of the project?

- ◉ Yes
- ○ No
- ○ No opinion

6.3 If yes, what?

assessment and listing of related standards

6.4 Please briefly explain how the project made use of these existing standards:

6.5 Please indicate how important the use of these standards have been for the success of your project.

- ○ Of no importance

- Of little importance
- Of some importance
- Of major importance

6.6 To what extent has using existing standards within your project led to the following categories of benefit:

	Not at all	To a small extent	To a medium extent	To a large extent
Improved understanding of current state of the art				
Improved technical knowledge within the consortium				
Improved efficiency of the project activities				
Improved quality of outputs from the project				
Other				

6.8 Please indicate whether any of the following wider impacts on innovation are likely as a result of your project making direct use of one or more existing standards. Please indicate all that apply:

	In the short-term	In the medium to longer term
Improved design of products, services or processes		●
Faster or easier market access (incl. European or international)		
Improved capacity to respond to EU regulation		●
Improved interoperability of products, services or processes		●
Improved access to public procurement		
Higher confidence level of consumers		
Enabling the display of a mark of product or process quality		
Wider use of recognised methodologies, processes or terminology		●
Other		

7 About new or revised standards

*

7.1 Has your project directly involved or led to a specific recommendation or proposal for the development of new or revised standards or was aimed at supporting the development or revision of a standard already under development?

- Yes
- ● No
- I don't know

8 Best practices

We are planning to proceed with a deep analysis of a number of projects that have led to the development of a European standard or workshop agreement. These projects will then be used by the Commission to highlight and explain these benefits to the wider research community.

*8.1 Do you think that your project would be an interesting and useful example for a best practice case in terms of valorisation of R&I results through existing, revised or new standards?

- Yes
- ● No

*8.2 Would you consider using, proposing or developing standards as part of future research projects?

- Yes
- ● No

*8.3 Would you be interested in clustering with other projects funded by the Framework Programme to work on the same standard?

- ● Yes
- No

8.4 Please explain your answer further:

We cold be related to projects focusing on Cooperative ITS systems as well as smart manufacturing systems support safe human robot collaboration tasks

*8.5 In another R&I project would you address standardisation in another way?

- Yes
- ● No

8.6 If yes, how?

*8.7 Would you start the standardisation process at another stage if you were again a grantee of a public R&I programme?

- Yes
- No

8.8 Please explain:

8.9 Do you have any suggestions for how the links between research, innovation and standardisation could be strengthened?

* 8.10 Would you be willing to assist us in describing best practice cases using your project as an example (through provision of project documentation and a telephone interview)?

- Yes
- No

8.11 If yes, please provide your current contact details (name, e-mail, phone number):

8.12 Please include any other comments not covered by the previous questions:

We thank you for completing this questionnaire. Please submit your answers by pressing the button below.

8.13 Free Text Question

8.14 Have you considered collaboration with the International Organisations for Standardisation (ISO), the International Electrotechnical Commission (IEC) or the International Telecommunication Union (ITU)?

	Yes	No
* ISO	●	○
* IEC	○	●
* ITU	○	●

* Other	●	○

Contact

Gergely.TARDOS@ec.europa.eu

6.3 Annex 3 – Standardization related questions for the CIAG meeting survey

CPSoSAware Commercial Interest Advisory Group meeting assisting questionnaire

Dear CPSoSAware CIAG Member,

This questionnaire includes a number of questions concerning CPSoSAware components exploitation and standardization.

The components will be presented during the meeting (18.11.2022), you are kindly requested to fill in the questionnaire after the presentation.

The first part of this questionnaire is focused on standardization activities. These questions might not be discussed in details during the meeting due to limited time. Please, give us your answers here.

The second part consists of questions on components exploitation and will be partially discussed during the meeting, please fill in if you have any further comments which were not discussed during the meeting.

Thank you for your attention and advice,

The CPSoSAware project consortium members

1

Name

Enter your answer

Standardization

2

The CPSoSaware project is developing technologies for an innovative CPS approach.
No consortium members has been directly implementing standardization activities, and the developments are currently below TRL 5. In this context we would like to ask to you if, in your opinion:

(1) any of the main developments of the project might be affected, in its future developments/exploitation path, by the current standardization framework?

(2) any of the main developments of the project is introducing concept that might affect the future standardization framework (change or update of existing standards)?

3

Which of the specific technologies, to your opinion is interesting and you think should be made available in the market (scale from 1 – "no interest", to 5 "I want it")

	1 (No interest)	2	3	4	5 (I want it)
V2X simulator	○	○	○	○	○
Driver State Monitoring	○	○	○	○	○
Semantic Information Fusion Framework	○	○	○	○	○
Homezone Perception Engine	○	○	○	○	○
Data storage and transformation engine	○	○	○	○	○
PoCL-R for distributed edge offloading	○	○	○	○	○
Mozart - System Orchestrator	○	○	○	○	○
Cooperative Awareness Solutions	○	○	○	○	○
Quantum Resistant Hardware Security Token	○	○	○	○	○
Security Runtime Monitor Module	○	○	○	○	○
Extended Reality System in HRC application	○	○	○	○	○
Posture and Anthropometrics Recognition	○	○	○	○	○
Operator's state monitoring	○	○	○	○	○

4

Which of the specific technologies, to your opinion is significantly affected by current regulation framework (from 1 "not affected" – to 5 "potentially forbidden")

	1 (Not affected)	2	3	4	5 (Potentially forbidden)
V2X simulator	○	○	○	○	○
Driver State Monitoring	○	○	○	○	○
Semantic Information Fusion Framework	○	○	○	○	○
Homezone Perception Engine	○	○	○	○	○
Data storage and transformation engine	○	○	○	○	○
PoCL-R for distributed edge offloading	○	○	○	○	○
Mozart - System Orchestrator	○	○	○	○	○
Cooperative Awareness Solutions	○	○	○	○	○
Quantum Resistant Hardware Security Token	○	○	○	○	○
Security Runtime Monitor Module	○	○	○	○	○
Extended Reality System in HRC application	○	○	○	○	○
Posture and Anthropometrics Recognition	○	○	○	○	○
Operator's state monitoring	○	○	○	○	○

5

Which of the specific technologies, if applied, would suggest an update of regulation and with what impact (1 "low"- 5"high: need of new standard")

	1 (Low)	2	3	4	5 (High: need of new standard)
(1) V2X simulator	○	○	○	○	○
(2) Driver State Monitoring	○	○	○	○	○
(3) Semantic Information Fusion Framework	○	○	○	○	○
(4) Homezone Perception Engine	○	○	○	○	○
(5) Data storage and transformation engine	○	○	○	○	○
(6) PoCL-R for distributed edge offloading	○	○	○	○	○
(7) Mozart - System Orchestrator	○	○	○	○	○
(8) Cooperative Awareness Solutions	○	○	○	○	○
(9) Quantum Resistant Hardware Security Token	○	○	○	○	○
(10) Security Runtime Monitor Module	○	○	○	○	○
(11) Extended Reality System in HRC application	○	○	○	○	○
(12) Posture and Anthropometrics Recognition	○	○	○	○	○
(13) Operator's state monitoring	○	○	○	○	○

6

Write the standard/Law you think is mainly related to the risk of interference written above (question 4), if you know it or helping keywords to identify it. Pleas, indicate to which of the components it relates (1-12).

Enter your answer

Relation to standards

With reference to the CPSoSaware technologies you have been introduced to, select for each of the technologies, how, in your opinion they are related to the following standard high level topics

7

Communication protocols

	No	Difficult to say	Yes
(1) V2X simulator	○	○	○
(2) Driver State Monitoring	○	○	○
(3) Semantic Information Fusion Framework	○	○	○
(4) Homezone Perception Engine	○	○	○
(5) Data storage and transformation engine	○	○	○
(6) PoCL-R for distributed edge offloading	○	○	○
(7) Mozart - System Orchestrator	○	○	○
(8) Cooperative Awareness Solutions	○	○	○
(9) Quantum Resistant Hardware Security Token	○	○	○
(10) Security Runtime Monitor Module	○	○	○
(11) Extended Reality System in HRC application	○	○	○
(12) Posture and Anthropometrics Recognition	○	○	○
(13) Operator's state monitoring	○	○	○

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Hardware Requirements

	No	Difficult to say	Yes
(1) V2X simulator	○	○	○
(2) Driver State Monitoring	○	○	○
(3) Semantic Information Fusion Framework	○	○	○
(4) Homezone Perception Engine	○	○	○
(5) Data storage and transformation engine	○	○	○
(6) PoCL-R for distributed edge offloading	○	○	○
(7) Mozart - System Orchestrator	○	○	○
(8) Cooperative Awareness Solutions	○	○	○
(9) Quantum Resistant Hardware Security Token	○	○	○
(10) Security Runtime Monitor Module	○	○	○
(11) Extended Reality System in HRC application	○	○	○
(12) Posture and Anthropometrics Recognition	○	○	○
(13) Operator's state monitoring	○	○	○

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Safety Requirements

	No	Difficult to say	Yes
(1) V2X simulator	○	○	○
(2) Driver State Monitoring	○	○	○
(3) Semantic Information Fusion Framework	○	○	○
(4) Homezone Perception Engine	○	○	○
(5) Data storage and transformation engine	○	○	○
(6) PoCL-R for distributed edge offloading	○	○	○
(7) Mozart - System Orchestrator	○	○	○
(8) Cooperative Awareness Solutions	○	○	○
(9) Quantum Resistant Hardware Security Token	○	○	○
(10) Security Runtime Monitor Module	○	○	○
(11) Extended Reality System in HRC application	○	○	○
(12) Posture and Anthropometrics Recognition	○	○	○
(13) Operator's state monitoring	○	○	○

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Security requirements

	No	Difficult to say	Yes
(1) V2X simulator	○	○	○
(2) Driver State Monitoring	○	○	○
(3) Semantic Information Fusion Framework	○	○	○
(4) Homezone Perception Engine	○	○	○
(5) Data storage and transformation engine	○	○	○
(6) PoCL-R for distributed edge offloading	○	○	○
(7) Mozart - System Orchestrator	○	○	○
(8) Cooperative Awareness Solutions	○	○	○
(9) Quantum Resistant Hardware Security Token	○	○	○
(10) Security Runtime Monitor Module	○	○	○
(11) Extended Reality System in HRC application	○	○	○
(12) Posture and Anthropometrics Recognition	○	○	○
(13) Operator's state monitoring	○	○	○

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Privacy requirements

	No	Difficult to say	Yes
(1) V2X simulator	○	○	○
(2) Driver State Monitoring	○	○	○
(3) Semantic Information Fusion Framework	○	○	○
(4) Homezone Perception Engine	○	○	○
(5) Data storage and transformation engine	○	○	○
(6) PoCL-R for distributed edge offloading	○	○	○
(7) Mozart - System Orchestrator	○	○	○
(8) Cooperative Awareness Solutions	○	○	○
(9) Quantum Resistant Hardware Security Token	○	○	○
(10) Security Runtime Monitor Module	○	○	○
(11) Extended Reality System in HRC application	○	○	○
(12) Posture and Anthropometrics Recognition	○	○	○
(13) Operator's state monitoring	○	○	○

Standardization bodies/community communication

Which pathway you suggest to take for each of the identified technologies in order to bring the specific information to standardization bodies/community

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V2X simulator

- [ ] No action required
- [ ] Dissemination of the information in general scientific/technical community
- [ ] Dissemination of the information in Standardization specific community
- [ ] Contact with National Standardization body or technical committee to suggest an update of a standard (write contact in 'other' field in case you have suggestions)
- [ ] Transfer information to European Projects/clusters active in the standardization field (write acronym in 'other' field in case you have suggestions)
- [ ] Other

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Driver State Monitoring

- [ ] No action required
- [ ] Dissemination of the information in general scientific/technical community
- [ ] Dissemination of the information in Standardization specific community
- [ ] Contact with National Standardization body or technical committee to suggest an update of a standard (write contact in 'other' field in case you have suggestions)
- [ ] Transfer information to European Projects/clusters active in the standardization field (write acronym in 'other' field in case you have suggestions)
- [ ] Other

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Semantic Information Fusion Framework

- [ ] No action required
- [ ] Dissemination of the information in general scientific/technical community
- [ ] Dissemination of the information in Standardization specific community
- [ ] Contact with National Standardization body or technical committee to suggest an update of a standard (write contact in 'other' field in case you have suggestions)
- [ ] Transfer information to European Projects/clusters active in the standardization field (write acronym in 'other' field in case you have suggestions)
- [ ] Other

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Homezone Perception Engine

- [ ] No action required
- [ ] Dissemination of the information in general scientific/technical community
- [ ] Dissemination of the information in Standardization specific community
- [ ] Contact with National Standardization body or technical committee to suggest an update of a standard (write contact in 'other' field in case you have suggestions)
- [ ] Transfer information to European Projects/clusters active in the standardization field (write acronym in 'other' field in case you have suggestions)
- [ ] Other

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Data storage and transformation engine

- [ ] No action required
- [ ] Dissemination of the information in general scientific/technical community
- [ ] Dissemination of the information in Standardization specific community
- [ ] Contact with National Standardization body or technical committee to suggest an update of a standard (write contact in 'other' field in case you have suggestions)
- [ ] Transfer information to European Projects/clusters active in the standardization field (write acronym in 'other' field in case you have suggestions)
- [ ] Other

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PoCL-R for distributed edge offloading

- [ ] No action required
- [ ] Dissemination of the information in general scientific/technical community
- [ ] Dissemination of the information in Standardization specific community
- [ ] Contact with National Standardization body or technical committee to suggest an update of a standard (write contact in 'other' field in case you have suggestions)
- [ ] Transfer information to European Projects/clusters active in the standardization field (write acronym in 'other' field in case you have suggestions)
- [ ] Other

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Mozart - System Orchestrator

- [ ] No action required
- [ ] Dissemination of the information in general scientific/technical community
- [ ] Dissemination of the information in Standardization specific community
- [ ] Contact with National Standardization body or technical committee to suggest an update of a standard (write contact in 'other' field in case you have suggestions)
- [ ] Transfer information to European Projects/clusters active in the standardization field (write acronym in 'other' field in case you have suggestions)
- [ ] Other

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Mozart - System Orchestrator

- [ ] No action required
- [ ] Dissemination of the information in general scientific/technical community
- [ ] Dissemination of the information in Standardization specific community
- [ ] Contact with National Standardization body or technical committee to suggest an update of a standard (write contact in 'other' field in case you have suggestions)
- [ ] Transfer information to European Projects/clusters active in the standardization field (write acronym in 'other' field in case you have suggestions)
- [ ] Other

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Cooperative Awareness Solutions

- [ ] No action required
- [ ] Dissemination of the information in general scientific/technical community
- [ ] Dissemination of the information in Standardization specific community
- [ ] Contact with National Standardization body or technical committee to suggest an update of a standard (write contact in 'other' field in case you have suggestions)
- [ ] Transfer information to European Projects/clusters active in the standardization field (write acronym in 'other' field in case you have suggestions)
- [ ] Other

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Quantum Resistant Hardware Security Token

- [ ] No action required
- [ ] Dissemination of the information in general scientific/technical community
- [ ] Dissemination of the information in Standardization specific community
- [ ] Contact with National Standardization body or technical committee to suggest an update of a standard (write contact in 'other' field in case you have suggestions)
- [ ] Transfer information to European Projects/clusters active in the standardization field (write acronym in 'other' field in case you have suggestions)
- [ ] Other

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Security Runtime Monitor Module

- [ ] No action required
- [ ] Dissemination of the information in general scientific/technical community
- [ ] Dissemination of the information in Standardization specific community
- [ ] Contact with National Standardization body or technical committee to suggest an update of a standard (write contact in 'other' field in case you have suggestions)
- [ ] Transfer information to European Projects/clusters active in the standardization field (write acronym in 'other' field in case you have suggestions)
- [ ] Other

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Extended Reality System in HRC application

- [ ] No action required
- [ ] Dissemination of the information in general scientific/technical community
- [ ] Dissemination of the information in Standardization specific community
- [ ] Contact with National Standardization body or technical committee to suggest an update of a standard (write contact in 'other' field in case you have suggestions)
- [ ] Transfer information to European Projects/clusters active in the standardization field (write acronym in 'other' field in case you have suggestions)
- [ ] Other

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Posture and Anthropometrics Recognition

- [ ] No action required
- [ ] Dissemination of the information in general scientific/technical community
- [ ] Dissemination of the information in Standardization specific community
- [ ] Contact with National Standardization body or technical committee to suggest an update of a standard (write contact in 'other' field in case you have suggestions)
- [ ] Transfer information to European Projects/clusters active in the standardization field (write acronym in 'other' field in case you have suggestions)
- [ ] Other

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Operator's state monitoring

- [ ] No action required
- [ ] Dissemination of the information in general scientific/technical community
- [ ] Dissemination of the information in Standardization specific community
- [ ] Contact with National Standardization body or technical committee to suggest an update of a standard (write contact in 'other' field in case you have suggestions)
- [ ] Transfer information to European Projects/clusters active in the standardization field (write acronym in 'other' field in case you have suggestions)
- [ ] Other

6.4 Annex 4 – Feedback to Standardization related questions for the CIAG meeting survey

1	Name (anonymized)	Expert 1	Expert 2	Expert 3
2	The CPSoSaware project is developing technologies for an innovative CPS approach. No consortium members has been directly implementing standardization activities, and the developments are currently below TRL 5. In this contest we would like to ask to you if, in your opinion:	I see potential connection points with existing and evolving standards that should be explored by the consortium in the following areas: - V2X communication framework (simulator) - Data storage and transformation engine - Quantum Resistant Hardware Security Token Both points (1) and (2) from the question above are relevant for these areas in my opinion.		The project provides a promising set of solutions and technologies. As far as I know, no solution provided by the project might be affected by the current standardization frameworks. At the same time, the project suggests a set of solutions that might be good inputs for future reference initiatives and SDOs. However, we should take into account the project touches upon different sectors of technology such as communication, data, cybersecurity, etc. so it is important to identify the correct reference initiative and SDOs.
	1) any of the main developments of the project might be affected, in its future developments/exploitation path, by the current standardization framework.			
	2) any of the main developments of the project is introducing concept that might affect the future standardization framework (change or update of existing standards)			

3	Which of the specific technologies, to your opinion is interesting and you think should be made available in the market (scale from 1 – "no interest", to 5 "I want it")	V2X simulator	4	4	3
		Driver State Monitoring	5 (I want it)	4	3
		Semantic Information Fusion Framework	2	4	4
		Homezone Perception Engine	2	3	5 (I want it)
		Data storage and transformation engine	2	2	4
		PoCL-R for distributed edge offloading	3	2	5 (I want it)
		Mozart - System Orchestrator	3	2	3
		Cooperative Awareness Solutions	4	3	4
		Quantum Resistant Hardware Security Token	4	3	3
		Security Runtime Monitor Module	3	3	4
		Extended Reality System in HRC application	5 (I want it)	3	5 (I want it)
		Posture and Anthropometrics Recognition	5 (I want it)	3	4
		Operator's state monitoring	4	3	4
4	Which of the specific technologies, to your opinion is significantly affected by current regulation framework (from 1 "not affected" – to 5 "potentially forbidden")	V2X simulator	2	3	1 (Not affected)
		Driver State Monitoring	4	1 (Not affected)	3
		Semantic Information Fusion Framework	1 (Not affected)	1 (Not affected)	4
		Homezone Perception Engine	2	3	4
		Data storage and transformation engine	1 (Not affected)	1 (Not affected)	3
		PoCL-R for distributed edge offloading	1 (Not affected)	3	3
		Mozart - System Orchestrator	1 (Not affected)	3	2
		Cooperative Awareness Solutions	3		2
		Quantum Resistant Hardware Security Token	2		2
		Security Runtime Monitor Module	2	4	2
		Extended Reality System in HRC application	3	3	3
		Posture and Anthropometrics Recognition	1 (Not affected)	2	3
		Operator's state monitoring	2	1 (Not affected)	3
5	Which of the specific technologies, if applied, would suggest an update of regulation and with what impact (1 "low"- 5"high: need of new standard")	V2X simulator	2		2
		Driver State Monitoring	3		2
		Semantic Information Fusion Framework	1 (Low)		4
		Homezone Perception Engine	1 (Low)		4
		Data storage and transformation engine	1 (Low)		3
		PoCL-R for distributed edge offloading	2		2
		Mozart - System Orchestrator	1 (Low)		2
		Cooperative Awareness Solutions	3		2
		Quantum Resistant Hardware Security Token	3		2
		Security Runtime Monitor Module	3		3
		Extended Reality System in HRC application	3		4
		Posture and Anthropometrics Recognition	3		4
		Operator's state monitoring	3		4

6 - Write the standard/Law you think is mainly related to the risk of interference written above (question 4), if you know it or helping keywords to identify it. Pleae indicate to which of the components it relates (1-12)

Expert 1	Expert 2	Expert 3
Overall, I think the risk of regulatory interference is relatively low. The most relevant keywords would be security (for Cooperative Awareness Solutions, Quantum Resistant Hardware Security Token and Security Runtime Monitor Module), privacy (for Driver State Monitoring and Operator's state monitoring) and safety at work and ergonomics (for Extended Reality System in HRC application and Posture and Anthropometrics Recognition).		Probably the main concern is GDPR and data sovereignty related issues. Other technical items not being covered today by standards probably soon will be addressed.

With reference to the CPSoSaware technologies you have been introduced to, which select, to your opinion if they are related to Standard high level topics

			Expert 1	Expert 2	Expert 3
7	Communication protocols	V2X simulator	Yes		Yes
		Driver State Monitoring	No	Difficult to say	Difficult to say
		Semantic Information Fusion Framework	No	Difficult to say	Yes
		Homezone Perception Engine	No	Difficult to say	Yes
		Data storage and transformation engine	No	No	Difficult to say
		PoCL-R for distributed edge offloading	Yes	Yes	Yes
		Mozart - System Orchestrator	No	No	Difficult to say
		Cooperative Awareness Solutions	Yes	Difficult to say	Yes
		Quantum Resistant Hardware Security Token	No	Difficult to say	Difficult to say
		Security Runtime Monitor Module	Difficult to say	Yes	Yes
		Extended Reality System in HRC application	No	Difficult to say	Yes
		Posture and Anthropometrics Recognition	No	Difficult to say	Difficult to say
		Operator's state monitoring	No	Difficult to say	Yes

8	**Hardware Requirements**	V2X simulator	No	Difficult to say	Yes
		Driver State Monitoring	Yes	Difficult to say	Yes
		Semantic Information Fusion Framework	No	Difficult to say	Yes
		Homezone Perception Engine	Difficult to say	Difficult to say	Yes
		Data storage and transformation engine	No	No	Yes
		PoCL-R for distributed edge offloading	Difficult to say	Yes	Yes
		Mozart - System Orchestrator	No	No	Difficult to say
		Cooperative Awareness Solutions	Yes	Difficult to say	Yes
		Quantum Resistant Hardware Security Token	Yes	Yes	Yes
		Security Runtime Monitor Module	No	Yes	Difficult to say
		Extended Reality System in HRC application	Difficult to say	Difficult to say	Yes
		Posture and Anthropometrics Recognition	Difficult to say	Difficult to say	Yes
		Operator's state monitoring	Difficult to say	Difficult to say	Yes
9	**Safety Requirements**	V2X simulator	Difficult to say	No	Difficult to say
		Driver State Monitoring	Yes	Yes	Yes
		Semantic Information Fusion Framework	No	Yes	Yes
		Homezone Perception Engine	Difficult to say	Yes	Yes
		Data storage and transformation engine	No	No	Yes
		PoCL-R for distributed edge offloading	No	Yes	Yes
		Mozart - System Orchestrator	No	No	Difficult to say
		Cooperative Awareness Solutions	Yes	Difficult to say	Yes
		Quantum Resistant Hardware Security Token	No	Difficult to say	Yes
		Security Runtime Monitor Module	No	Difficult to say	Yes
		Extended Reality System in HRC application	Difficult to say	Difficult to say	Yes
		Posture and Anthropometrics Recognition	No	Difficult to say	Yes
		Operator's state monitoring	Yes	Difficult to say	Yes
10	**Security requirements**	V2X simulator	Difficult to say	No	Difficult to say
		Driver State Monitoring	Difficult to say	Yes	Yes
		Semantic Information Fusion Framework	No	Difficult to say	Yes
		Homezone Perception Engine	No	Difficult to say	Yes
		Data storage and transformation engine	No	No	Yes
		PoCL-R for distributed edge offloading	Difficult to say	Yes	Yes
		Mozart - System Orchestrator	No	No	Yes
		Cooperative Awareness Solutions	Difficult to say	Difficult to say	Yes
		Quantum Resistant Hardware Security Token	Yes	Yes	Yes
		Security Runtime Monitor Module	Yes	Yes	Yes
		Extended Reality System in HRC application	No	Difficult to say	Yes
		Posture and Anthropometrics Recognition	No	Difficult to say	Yes
		Operator's state monitoring	No	Difficult to say	Yes

11	**Privacy requirements**	V2X simulator	No	No	Difficult to say
		Driver State Monitoring	Yes	Yes	Yes
		Semantic Information Fusion Framework	No	Difficult to say	Yes
		Homezone Perception Engine	No	Difficult to say	Yes
		Data storage and transformation engine	No	Difficult to say	Yes
		PoCL-R for distributed edge offloading	No	Yes	Yes
		Mozart - System Orchestrator	No	No	Difficult to say
		Cooperative Awareness Solutions	Difficult to say	Difficult to say	Yes
		Quantum Resistant Hardware Security Token	No	Difficult to say	Difficult to say
		Security Runtime Monitor Module	No	Difficult to say	Yes
		Extended Reality System in HRC application	No	Difficult to say	Yes
		Posture and Anthropometrics Recognition	Difficult to say	Difficult to say	Yes
		Operator's state monitoring	Yes	Difficult to say	Yes

12- Standardization Bodies/Community Communication:
Which pathway you suggest to take for each of the identified technologies in order to bring the specific information to standardization bodies/community

	Expert 2	**Expert 3**	**Expert 4**
V2X simulator3	Dissemination of the information in general scientific/technical community; Dissemination of the information in Standardization specific community;	Dissemination of the information in Standardization specific community; Dissemination of the information in general scientific/technical community;	Dissemination of the information in general scientific/technical community;
Driver State Monitoring3	No action required;	Dissemination of the information in general scientific/technical community;	Dissemination of the information in general scientific/technical community;
Semantic Information Fusion Framework3	No action required;	Dissemination of the information in general scientific/technical community;	Dissemination of the information in Standardization specific community; Dissemination of the information in general scientific/technical community;
Homezone Perception Engine3	No action required;	Dissemination of the information in general scientific/technical community;	Dissemination of the information in general scientific/technical community; Dissemination of the information in Standardization specific community;
Data storage and transformation engine3	Dissemination of the information in general scientific/technical community; Dissemination of the information in Standardization specific community;	No action required;	Dissemination of the information in Standardization specific community; Dissemination of the information in general scientific/technical community;
PoCL-R for distributed edge offloading3	Dissemination of the information in general scientific/technical community; Dissemination of the information in Standardization specific community;	Dissemination of the information in Standardization specific community; Contact with National Standardization body or technical committee to suggest an update of	Dissemination of the information in general scientific/technical community; Dissemination of the information in Standardization specific community;

		a standard (write contact in 'other' field in case you have suggestions);	
Mozart - System Orchestrator	No action required;	No action required;	Dissemination of the information in general scientific/technical community;
Cooperative Awareness Solutions3	Dissemination of the information in general scientific/technical community; Dissemination of the information in Standardization specific community;		Dissemination of the information in Standardization specific community; Dissemination of the information in general scientific/technical community;
Quantum Resistant Hardware Security Token3	Dissemination of the information in general scientific/technical community; Dissemination of the information in Standardization specific community; Contact with wolfSSL community, which has apparently already been initiated by the consortium;		Dissemination of the information in general scientific/technical community;
Security Runtime Monitor Module3	Dissemination of the information in general scientific/technical community; Dissemination of the information in Standardization specific community;		Dissemination of the information in general scientific/technical community; Dissemination of the information in Standardization specific community;
Extended Reality System in HRC application3	Dissemination of the information in general scientific/technical community;		Dissemination of the information in general scientific/technical community; Dissemination of the information in Standardization specific community;
Posture and Anthropometrics Recognition3	Dissemination of the information in general scientific/technical community;		Dissemination of the information in general scientific/technical community; Dissemination of the information in Standardization specific community;
Operator's state monitoring3	Dissemination of the information in general scientific/technical community;	Dissemination of the information in general scientific/technical community;	Dissemination of the information in general scientific/technical community; Dissemination of the information in Standardization specific community;