Vídeo Industrial para visão EXPANdida em operações à Distância

VIEXPAND
E6.2
CURRENT STANDARDISATION AND EVOLUTION II (EN)
ESTADO ATUAL DE ESTANDARDIZAÇÃO E EVOLUÇÕES II (PT)

Contractual Date of Delivery:	28/Feb/2023
Actual Date of Delivery:	28/Feb/2023
Editor:	João Gil (TWEVO)
Authors:	João Gil (TWEVO), Pedro A. Assunção, Lino Ferreira (IT)
Internal reviewers:	Carlos Ribeiro (TWEVO), Pedro A. Assunção (IT)
Workpackage (EN)/Atividade (PT):	6
Security:	PU
Version:	1.0
Total number of pages:	8

SUMMARY (EN):

This Deliverable presents the final regulation-related issues where VIEXPAND technical and commercial outcome requires post-project attention. Most actual critical regulation topics concern commercialisation compliance and client's needs (CE marking and health and safety demands), depending on the application in the factory.
Video Compression issues have been widely discussed and developed on the onset of the project, in Deliverable E6.1 and during the project development.

SUMÁRIO (PT):

Este Entregável apresenta as questões finais relacionadas com a regulamentação em que o resultado técnico e comercial do VIEXPAND requer atenção pós-projecto. A maioria dos tópicos críticos de regulamentação atuais diz respeito à conformidade da comercialização e às necessidades do cliente (marcação CE e exigências de saúde e segurança), dependendo da aplicação na fábrica.
As questões de compressão de vídeo foram amplamente discutidas e desenvolvidas no início do projeto, no Deliverable E6.1 e durante o desenvolvimento do projeto.

Keyword list: Regulation, Standardisation, CE marking, Machine Directive

Cofinanciado por:

CENTRO 2020 PORTUGAL 2020 UNIÃO EUROPEIA Fundo Europeu de Desenvolvimento Regional

The VIEXPAND project is funded under Research and Technological Development Incentive Scheme - CO-PROMOTION | Centro2020 | P2020 | European Regional Development Funds.

Table of Contents

List of Acronyms

CAPEX	Capital Expenditure
CCTV	Closed Circuit Television
CE	*Conformité Europeenne*
HEVC	High Efficiency Video Coding
HW	Hardware
MD	Machinery Directive
OPEX	Operational Expenditure
PC	Personal Computer
ROI	Region Of Interest
SOM	System-on-Module
SW	Software

1. Introduction

This Deliverable presents the final regulation-related issues where VIEXPAND technical and commercial outcome requires post-project attention. According to our view and from current acquired knowledge of the relevant industrial context, widely acquired during the VIEXPAND project together with VIDRALA as project partner, most actual critical regulation topics concern commercialisation compliance and client's needs. This regards *Conformité Europeenne* (CE) marking and compliance to health and safety demands, closer to the client and objects of application in the factory, e.g., workers.

Video Compression issues have been widely discussed and developed on the onset of the project (in Deliverable E6.1) and during the project development. Such topic was then crucial for the preparation and planning of the project's R&D technical aspects, as well as during its R&D implementation. These, naturally, acquire a secondary role at the end of the project. We anyhow have kept attention for future changes in video coding/decoding regulation.

2. Video Coding/Decoding Issues

We add no particular information and topics to those presented in past Deliverable E6.1, centred on video coding, in particular dealing with the High Efficiency Video Coding (HEVC)/H.265 standard and respective implementation of Regions Of Interest (ROIs). As planned, the VIEXPAND project has taken into account all relevant HEVC/H.265 standard guidelines to guarantee its use with any other commercial video system. For this, we do not envisage any future additional issues.
During the project, a new standard (Versatile Video Coding) was approved, not being an option to the project. Also, the standardisation activity that remains regarding HEVC does not focus on aspects relevant to the project. But, most importantly, the technical innovations developed in the project were all compatible with standard encoders, thus no changes to standards were required. This is a crucial positive aspect, that in fact had to be guaranteed by the project, because any standard encoder can be used in the technical framework of the project and beyond, without modifications.

3. CE Marking in VIEXPAND

The evolution of the project along its time-line has been directed towards having a modular Commercial Off-The-Shelf (COTS) system. This follows TWEVO's experience and knowledge on complex electronic, Hardware (HW) and Software (SW) implementations.

The technical advantage of modularity is well understood in the R&D and engineering points-of-view. The work is aided by the step-by-step implementation and operation of already functioning commercial parts. In case of malfunction, it is better identified and such parts are

dealt-with in separate, reducing complexity and isolating problems, causes and solutions and eventual replacements.

In parallel, there are direct business advantages in adopting such modular approach, regarding Operational Expenditure (OPEX) and Capital Expenditure (CAPEX): use, application, operation, experimentation and debug expenses are spread in time and along the project, while acquisition expenses are also spread in time. Also, the overall system is set not to depend on a single HW/SW provider, but rather on several diverse sources. Further, towards the comercial perspective, the final commercial outcome from the VIEXPAND project is highly flexible and customisable, with TWEVO being more quickly ready to provide a HW/SW VIEXPAND solution to a large set of diversified clients.

At the same time, and more related to this Deliverable, the modular COTS approach has major implications in regards to committing to CE marking. Just like the case of an assembled customised Personal Computer (PC) or a complex home and water heating system, the product outcome from the VIEXPAND project will be a HW and SW solution built of inter-operational commercial parts, all of which have their respective CE marking.

If the boxed or whole system is to be sold as a whole, it needs to still conform to CE Marking regulations and certification. Such assembly of CE-marked parts is an 'apparatus' that requires its own CE marking [source], following the necessary Directives. This is to say that, in that case, TWEVO is the manufacturer of such complete 'apparatus', therefore responsible for its conformity. This is the case of selling 'VIEXPAND AI' product, for example, consisting of the boxed Xilinx Kria K26 System-on-Module (SOM) board, network switch, the 2 respective power supplies, with internal cabling, external box and connectors, altogether as one system. The respective invoice indicates N units of the 'VIEXPAND AI' product, without any indication of its inner parts.

Another business model possibility, again with important implication on CE marking, is TWEVO selling all inner parts individually. This is to say, selling 1 unit of Xilinx Kria K26 System-on-Module (SOM) board, 1 unit of network switch, 2 units of respective power supplies, with internal cabling, 1 unit of external box and connectors, in separate invoice items in the same invoice, further adding SE and the service of putting them all working together. In this sense, TWEVO is not the manufacturer or the seller of the system, but rather the installer, mounting each of CE-marked item parts together, putting them working with its own SW. This is the case of desktop PCs assembled by PC shops. In fact, and not being totally correct, some shops do name, advertise and market such desktop PC and a whole 'shop name desktop PC' product, though not CE-marked. Another similar example is the case of engineers/technicians selling and installing a complete home and water heating system to their customer, in their home, composed of several modules of several brands (all CE-marked). The installers sell and invoice the system item by item, each of the items being CE-marked.

The former whole-system CE-marking prospect incurs in lower flexibility, more effort, longer time-to-market, and larger costs (to the manufacturer TWEVO and the client), since complete CE compliance efforts would be required and these would refer to a specific equipment

mounted altogether. Whereas the latter itemised-system CE-marking model better agrees with flexibility, faster market reach and lower costs. Further, adding the necessary video cameras or making use of already installed Closed Circuit Television (CCTV) cameras better fits this latter model, too.

All of these factors and methodologies, together rooting from the modular HW and SW approach, have crucial impact on product planning and business sustainability, as well as on technical and commercial solution soundness and robustness, with great implications in reaching the market.

4. Safety Norms in Industrial Safety Alarm Systems

During the VIEXPAND project, we have also undergone effort to evaluate regulation relative to safety norms in worker safety alarm systems. This is due to the fact that VIEXPAND product outcome may complement other safety systems, e.g., in forklift safety inside the warehouse hall, as in the planned second VIEXPAND project scenario. Such product may provide warning and information purposes, in real-time, for the machine operator, or may have the function of recording and analysing video data for off-line analysis. But, in order to be effective for the prospective client, some norms or guidelines need to be followed or planned for the future.

After extensive research on this matter, one should point out the following safety norm references, useful in this context:

- EU Machinery Directive (MD) [source];
- 'Guide to application of the Machinery Directive 2006/42/EC', Edition 2.2 – October 2019, (Update of 2nd Edition) [source];
- DIN EN ISO 3691 family of norms, from Industrial trucks — Safety requirements and verification, namely Part 1: Self-propelled industrial trucks, other than driverless trucks, variable-reach trucks and burden-carrier trucks, Part 4: Driverless industrial trucks and their systems and Part 5: Pedestrian-propelled trucks [source];

In the EU MD, clear mentioning of 'Warning devices' points out that "Where the health and safety of persons may be endangered by a fault in the operation of unsupervised machinery, the machinery must be equipped in such a way as to give an appropriate acoustic or light signal as a warning.", "Where machinery is equipped with warning devices these must be unambiguous and easily perceived. The operator must have facilities to check the operation of such warning devices at all times.", "The requirements of the specific Community Directives concerning colours and safety signals must be complied with.". Or under 'Warning of residual risks', 'Where risks remain despite the inherent safe design measures, safeguarding and complementary protective measures adopted, the necessary warnings, including warning devices, must be provided'. For the respective compliance, though not specified specifically how or by what means, it is our view that VIEXPAND product outcome will fit into these directive

requirements, as long as its fail-safe operation is verified, together or not with other complementary warning systems.

According to the 'Guide to application of the Machinery Directive 2006/42/EC', further aiding in the understanding of the MD:

- on 'Warning devices', "Section 1.7.1.2 deals with risks for persons due to faults in machinery or parts of machinery that are designed to operate without the permanent supervision of operators. The warning devices must be such as to inform the operators or other exposed persons of dangerous faults in order to enable the necessary action to protect persons at risk to be taken. Where appropriate, the warning devices can be fitted to the machinery itself or be activated at a distance.", and "Standard EN 61310-1 gives specifications for visual and acoustic signals.";
- on 'Warning of residual risks', "The requirement set out in section 1.7.2 refers to residual risks, that is to say, risks that cannot be eliminated or sufficiently reduced by inherently safe design measures and that cannot be completely prevented by integrated protective measures (...)";
- On 'Signs, signals and warnings', "The requirements set out in section 3.6.1 are complementary to the requirements set out in sections 1.7.1 to 1.7.3 on information and information devices, warning devices, warning of residual risks and the marking of information essential for safe use of machinery (:..) The third paragraph of section 3.6.1 deals with risks due to collisions between remote controlled or driverless mobile machinery and persons. Such machinery must be equipped with appropriate means to signal its movements such as acoustic and/or visual warning devices. Where necessary, protective devices must also be fitted to prevent collisions (...) The requirements set out in paragraph 3 of section 3.6.1 also apply to machinery with a ride-on driver intended to execute constant to-and-fro movements, such as, for example, certain road construction machinery or loaders, since the driver of such machinery may not be able to permanently monitor the area to the rear."

Also in ISO 3691-1, a reference is made to the requirement of a 'warning device' to avoid being run over, crushing, drawing-in or trapping, and impact. In ISO 3691-4, 'Signals and warning systems' are also indicated.".

Judging from the MD and ISO 3691 perspectives, within the second envisaged scenario, it is our view that our VIEXPAND product outcome may be used for the following:

- The smart real-time generation of warnings, directly to the forklift operator and to the central operations room on forklift-pedestrian distances, forklift driving properties (e.g., location and speed);
- The smart real-time generation of warnings, directly to the central operations room on pedestrian location in respect to prohibited or non-pedestrian zones;
- The smart off-line storage and resulting analysis of video data on warehouse movements, distribution and location of machines, personnel and other high-value assets;
- Complementary video information, monitoring and detection added to already existing warnings.

Following this, when providing a smart product/service for safety purposes based on VIEXPAND, special care and commitment need to be put into following the MD, in order to effectively provide its main function towards all stakeholders dealing with health, safety, and security in the factory. These include workers, owners, investors, insurance companies, machine manufacturers, medical professionals. For this, future effort needs to be undertaken in these senses, for the safe, failure-proof and responsible adoption and use of such product.

5. Conclusions

This Deliverable focuses on the current and future regulation issues that the VIEXPAND Consortium envisages for the project's commercial outcome. These mainly focus on CE making and safety requirements, with implications in future business model and adoption.

This evaluation, as hereby reported, has important impact on the future planning for technical and commercial purposes, for the evolution of VIEXPAND commercial outcome.