

1. Entity posing the challenge

- **KIMUA GROUP**

2. Challenge statemento

Incorporation of computer vision technologies in integral cargo handling solutions.

3. General context

KIMUA is a leader in load handling, lifting, and transport with its own work philosophy called "KIMUALITY", a philosophy that sets the highest standards of quality and traceability.

KIMUA offers solutions in the context of both engineering and manufacturing;

Engineering:

- KIMUA develops comprehensive engineering solutions aimed at providing the most appropriate solution for each customer. These solutions are aimed at solving problems related to lifting and transporting large loads in a cost-effective and optimised way following suitable ergonomic and handling criteria.
- KIMUA's highly-qualified engineering team covers the design, development, manufacture, and installation of large load handling solutions that contribute to safety, efficiency, and productivity.
- Traceability is guaranteed throughout the entire process, from the request for quotation, during the design phase, and up to the delivery of the product and subsequent invoicing. All designs and tools are certified and comply with the strictest quality and safety specifications on the market.

Manufacturing;

- The development of integral engineering solutions is continued throughout the manufacturing process, providing customers with the possibility of taking on turnkey projects.
- KIMUA guarantees that the solutions developed comply with the design specifications at documentary, dimensional, and process level through Factory Acceptance Testing (FAT). KIMUA is also capable of carrying out FAT at the customer's facilities for very complex systems or in special cases.
- FAT is used to correct any problems by taking advantage of KIMUA's technical experience and resources (assembly tests, function tests, load tests, etc.).
- KIMUA also supports the customer throughout the entire process, from fine-tuning the solutions to training technical staff in charge of operating them in real life, providing

support during the first on-site operational tests, and optimising the customer's future operations.

KIMUA's proposals are complemented by its range of services such as leasing, training, and testing.

- Leasing: KIMUA provides its customers with the opportunity to take advantage of load handling solutions that have already been developed, tested, and fully proven. The leased solutions are guaranteed to have the same characteristics as a new solution through testing and advanced re-manufacturing processes.
- Training: KIMUA provides theoretical and practical courses and master classes on handling and fastening for end users, focussing on customer safety.
- Testing;
 - LAMIA is KIMUA's test bench which has the capacity to carry out tests of up to 1,000 tonnes and which can be transported to the customer's facilities without the need for civil works.
 - LAMIA is fully modular, portable, monitored, and can transmit the tests live. The data and images generated during the test are shared through a secure interface, allowing customers to witness tests without having to travel, saving time and resources.
 - LAMIA can perform multiple types of tests such as bending, tensile, and torsion tests according to ISO/IEC 17025. Both laser and strain gauge monitoring can also be carried out to obtain more data on the behaviour of the parts.
 - KIMUA also has non-destructive testing equipment for tests such as liquid penetrant, magnetic particle, ultrasonic, visual inspection, and three-dimensional control.

KIMUA's products and services are mainly aimed at the following sectors:

- Onshore and Offshore Wind
- Railways
- Scientific
- Steelworks
- Aeronautics

4. The Challenge

1. Description of the challenge:

Lifting and transporting large loads is in itself a challenge that is further complicated when the manoeuvre takes place at a sufficient distance from the operator, causing problems related to a lack of visibility, loss of reference points, and the impossibility of understanding the parameters of the manoeuvre.

Being positioned far from the operation increases the risk of not achieving the manoeuvre, while also posing a risk to the operators' physical safety; therefore, the aim is to support the operator by providing information that guides the manoeuvres.

It is understood that this information could be provided by using technologies such as Computer Vision. In turn, this is understood as a combination of hardware and software which provides operational guidance based on images that are captured and processed. In KIMUA's case, the proposal is to visualise the images in situ using cameras placed on the lifting equipment in combination with advanced image recognition and decision-making based on the data acquired.

It is understood that this decision-making should be transmitted to the operator in the form of "action recommendations".

This challenge involves implementing a pilot project resulting in a proof of concept, thus demonstrating the capacity of these technologies to add value to KIMUA's services.

The proposal would be to start with less complex tools such as rocker arms, where the main challenge relates to load distribution, making recommendations accordingly.

It should be noted that KIMUA has already made progress in this challenge by incorporating cameras in some of its manufactured tools.

The ultimate goal of the proposed challenge is the possibility of operating the load handling tools autonomously through "deep automatic learning" techniques, with human intervention to merely validate the machine actions.

2. Main impacts

Incorporating these technologies into the tools designed and manufactured by KIMUA, providing customers with:

- Improved operator safety

- Reliable information on the manoeuvre being carried out to reduce the possibility of incidents taking place.
- Improved operational processes
 - Providing this support to the operator will improve the process of using KIMUA's solutions to the extent that operators will be able to reduce operation and assembly times, increasing the success of the manoeuvres carried out.
- Training of new operators
 - Providing a higher level of information and support to the operator will help solve problems related to generational change and the concentration of knowledge on load handling manoeuvres in highly experienced operators. This will allow new operators to take on difficult manoeuvres in a more agile and effective way thanks to the support received.

3. Main questions to be solved

- Would it be possible to apply a solution based on computer vision to carry out load handling operations from a distance?
- What would be the ideal support medium to transfer this information to the operator?

4. Technical characteristics of the challenge

The solutions are expected to be intuitive and simple to use for the operator, without the need for special training.

On a technological level, the capabilities of systems such as computer vision (CV cameras in 2D and 3D), LiDAR lasers, Machine & Deep Learning technologies, advanced sensor solutions, or others identified and applicable to the challenge posed shall be explored.