Unfilming of pallets

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Scope

In the age of the 4.0 industry, collaborative robots, called “cobots”, are able to work with operators to **enhance the global performance** of companies by **strengthening security** and **improving speed and efficiency**.

Cobots have been developed to provide a **flexible use**: Easily programmed and moved from one work station to another. Cobots allow the company to optimize the fabrication process and to **delete the no added value tasks**.

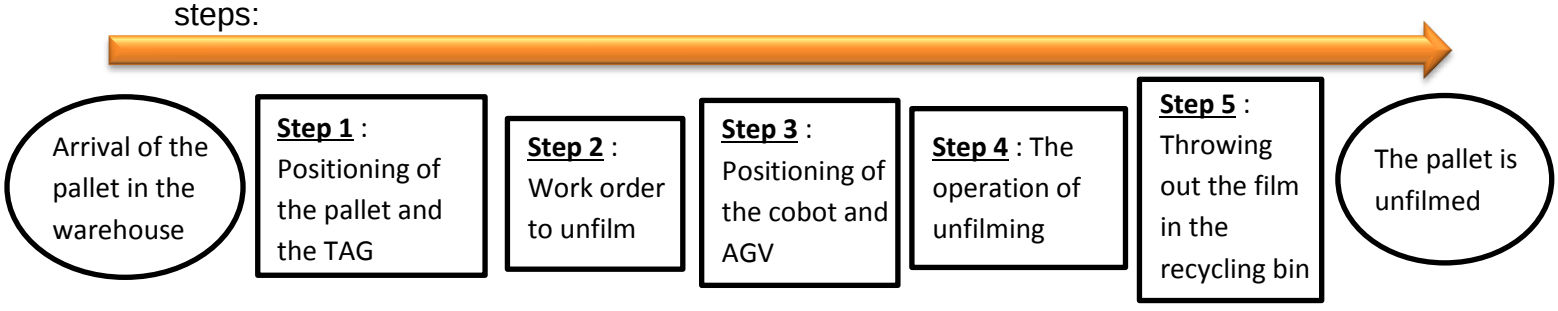
There is still a no added value operation which is not automatized in the flow of raw material, final product and packaging items: **the unfilming of pallets**. There are today about 600 million movements of pallets in France per year. Most of the time pallets are automatically filmed by machines to tie up and protect products. The filming operation is very fast and generally integrated at the end of the production line.

However the unfilming operation cannot be integrated at the end of the chain because this task is not continuously used in one working day. It is also done manually. That’s why we have developed a collaborative operation in which operators and cobots will succeed in unfilming pallets in a safe and quick way.

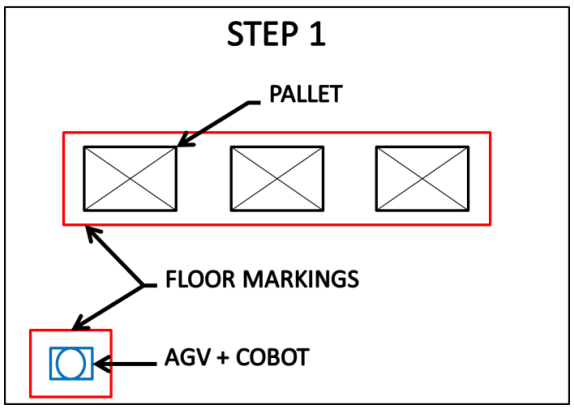
We will use a **humanoid cobot** placed on an **AGV**. We decide to equip this cobot with a **vision captor, a 2D lidar and** intelligent sensor with TOF camera. Eventually the cobot will handle a **reel** in its right arm and have a **clamp** in its left arm.

Description

Here is a flowchart representing the operation range and including the different steps:



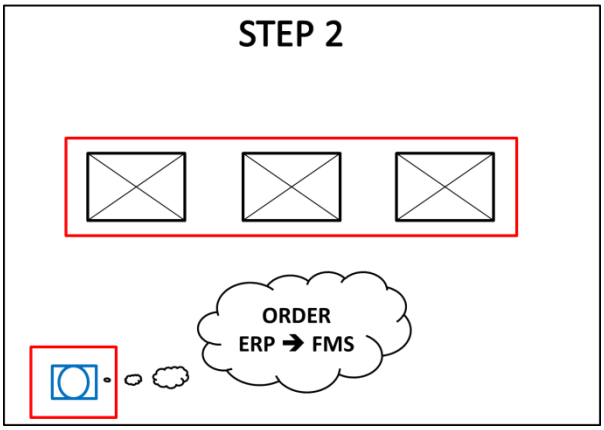
As a first step the operator takes the pallet down from the truck to bring it to a **specific place** built by the company.



First the operator has to **measure the size** of the pallet. Then he will start to **unfilm a tiny part** of the pallet in order to create a trigger in the film. The operator also knows in

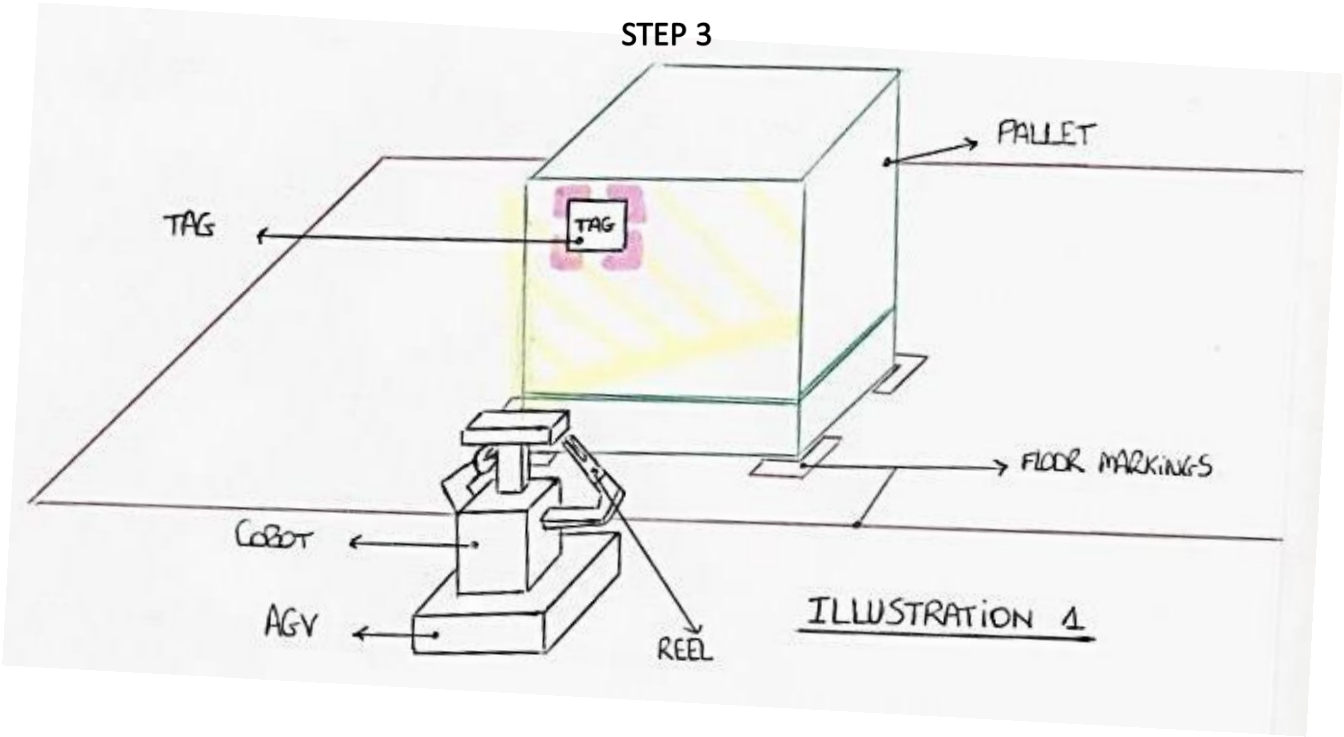
which direction the pallet has been filmed. He collects and writes this **information** in his **computer** to print a **specific TAG** on which all of this information will be written: the size of the pallet and the way the pallet has been filmed so as to get the cobot turn around it in the **right direction**.

In the meantime, the operator sends information to the company's ERP indicating that the pallet is available to be unfilmed. The ERP communicates with the **Fleet Management System** which commands the "cobot + AGV" to head for the pallet and indicates them to **get ready to unfilm** it.



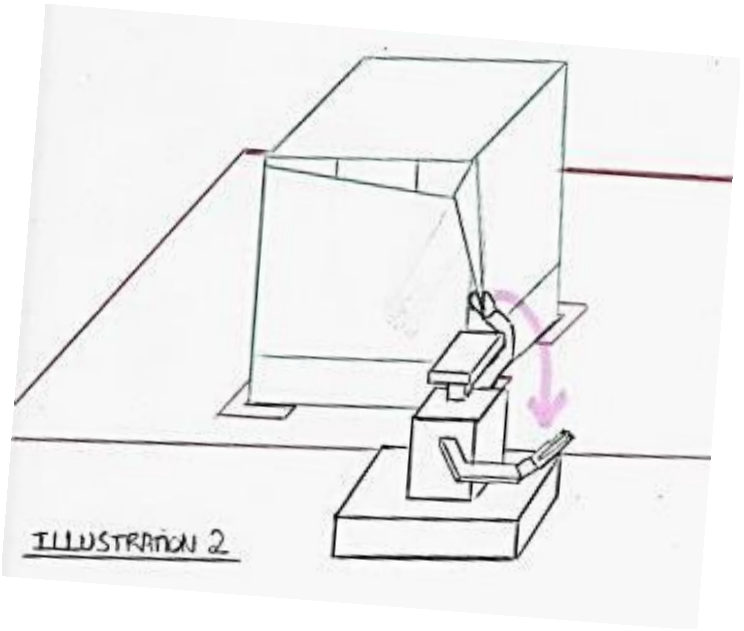
After printing the TAG the operator **sticks it on the trigger** of the film and indicates to the cobot that the pallet is available to be unfilmed. Moreover, we have placed an intelligent sensor on the "cobot + AGV" in order to precisely target the TAG on the pallet and place the "AGV + cobot" in front of it. Since the cobot knows the map of the layout, he is able to make for the front of the pallet and use the vision system of the **intelligent sensor** in order to look for the TAG. Notice that for **security reasons** AGV + cobot are provided with a **2D LIDAR** which **stops the AGV** if somebody is crossing the road of the AGV

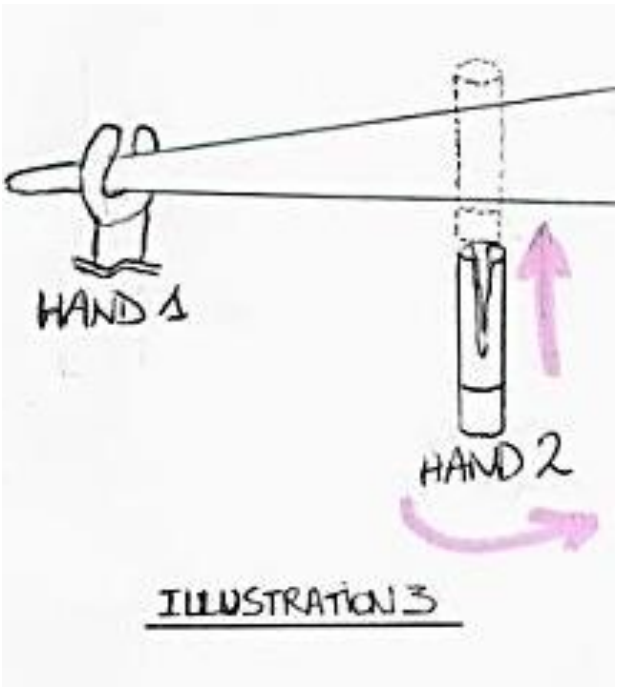
Once the TAG is found by the cobot, he reads the information written and analyses it. The unfilming of the pallet can begin.



Above we can see illustration number 1 which shows how the "cobot + AGV" are getting ready to unfilm the pallet in front of them.

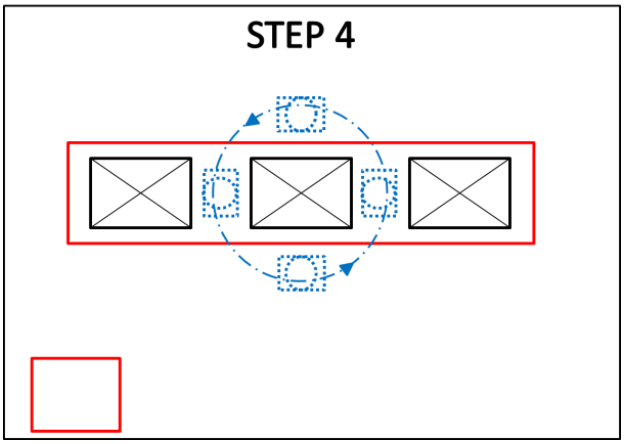
Once the Cobot + AGV have read the information written on the TAG, the cobot starts by **grabbing the TAG** and the plastic film with the clamp placed in its left arm and pulls the film toward him as we can see in the illustration number 2.





Then the cobot **puts the film in the reel** placed in the other arm. Once the film is between the two parts of the reel, the cobot starts getting the reel to turn around itself in order to **wind the plastic film onto the reel.**

Illustration number 3 shows how the tools of the cobot **work together** to wind the plastic film.



While the reel turns around itself, the AGV starts to turn around the pallet in the direction written on the TAG.

During the unfilming step, the cobot is able to **feel a tension** against its reel due to the **torque sensor** of its arm. This tension comes from the plastic film which is around the pallet. At the end of the operation, a section of the film falls down and doesn't resist to be wound. From that time the cobot **knows that there is still a precise number of rotation to do.**

Once the cobot + AGV group have made the necessary number of rotations for the complete unfilming of the pallet, they need to **evacuate the film** collected around the reel.

As soon as the cobot has finished winding the plastic film he heads for a specific **recycling bin** in which he will throw out the film. To do so the cobot has to use its two arms. The arm provided with the **clamp will grab the plastic** film which is wound around the reel and will **pull it in the opposite direction of the axe of the reel**.

Eventually the cobot has to open its clamp above the bin, throw out the plastic film and then **come back to its initial position**. While the cobot is unfilming the pallet, the operator has time to take another pallet down from the truck. Then he shunts the unfilmed pallet so he can **place the new filmed pallet** on the specific location. The Cobot and AGV can also unfilm this pallet and so on. The operation of unfilming is also carried out in **hidden time**.

Technical details

TAG: Label **containing all key information** provided by the ERP and got by the operator (dimensions of the pallet, filming direction, number of rotations…).

Reel: System of **film winding**. At the level of the design, this part is a slotted cylinder promoting the grip and the evacuation of the film.

Torque sensor: Measuring tool used in the industry to **evaluate the torque** during torsion test. In our case, this tool will allow the cobot to know quickly and efficiently the moment when the film is totally removed from the pallet.

AGV: Automated Guided Vehicles. A robot which **moves in an autonomous way without the human intervention**. In our application, the AGV will allow the group to follow a precise movement all around the pallet.

2D LIDAR: Device which emits a laser beam and receives an echo from it allowing to **determine the distance** of an object. In our solution, the safety aspect is taken in charge by this solution.

TOF camera + sensor: Is able to **read the TAG, situate the pallet** and **analyse the data** in order to choose a specific program which is going to be applied by the cobot.

Benefits

It is necessary to know that the use of the group “AGV + cobot” is able to help a company on many concrete points.

The first point is the **optimization of working time**. Indeed, our solution brings a **gain on low value-added tasks.** The benefice is not on the unfilming time itself but particularly by its functioning in hidden time, so facilitating the work of the operator thanks to this association. Thus, the unfilming time and procurement time of raw materials and finished goods are optimized.

The second point rests on the **flexibility of the system**. It is a major asset of these two technologies, which are AGV and cobot. Leaning on mobility and adaptability, the group will know how to move and turn wherever in the factory and its workstation.

The third point is **ergonomics**. Our solution suggests a strong collaboration between Human and cobot which enhance the improvement of the job’s condition. We know that in industry, **musculo-skeletal disorders** are an everyday concern. The operator is put throughout the day in unpleasant postures, impacting so considerably on the **global performance** of the company, in particular by constantly increasing the time carry out tasks.