3D-CartGRIP

Gripping system of trolleys for

EffiBOT

3D-CartGRIP

3D-CartGRIP automates the picking and unloading of Effidence **3D-Cart** trolleys, in factories or warehouses, as required.

Thanks to an innovative **3D trolley gripping system**, ensure the transport of a **large volume** of parts **safely** and in **all circumstances**: at high speed, following an emergency stop, on uneven ground.

Benefit from our **Follow-me 360°** collaborative technology, the **EffiBOT** gripped on the truck helps your operators move heavy loads.

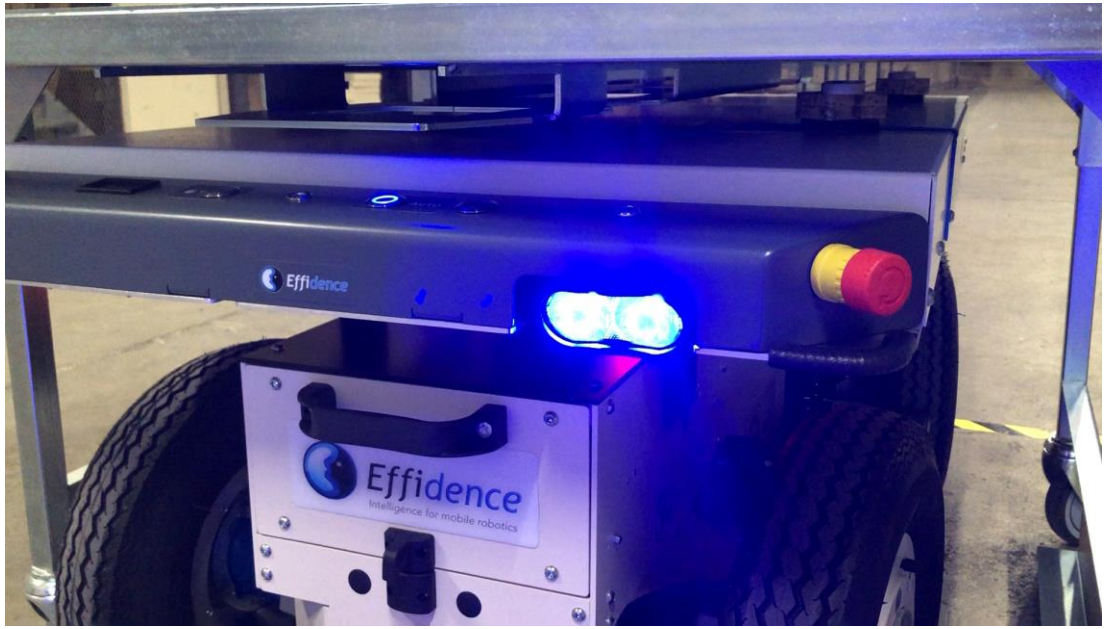
Ensure delivery **anywhere in the warehouse** by navigating close to the operators.

Taking of the trolley

Centering under the trolley

3 seconds to centre in front of the trolley

https://youtu.be/HJ6TOdp3x5s

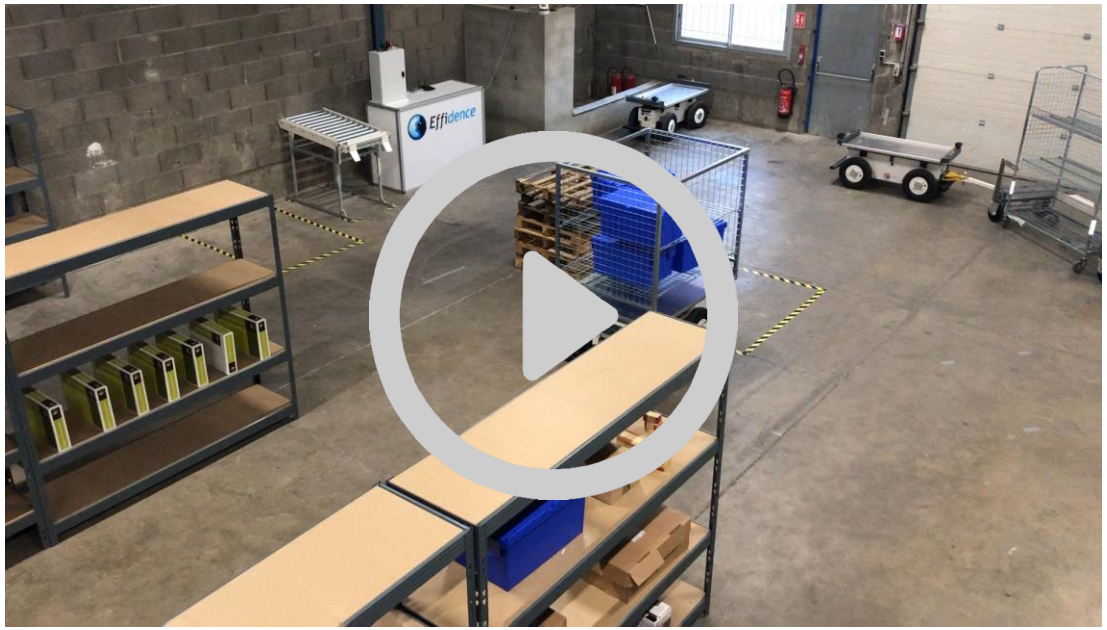


Trolley's gripping

10 seconds

https://youtu.be/pQNnC5InQjc

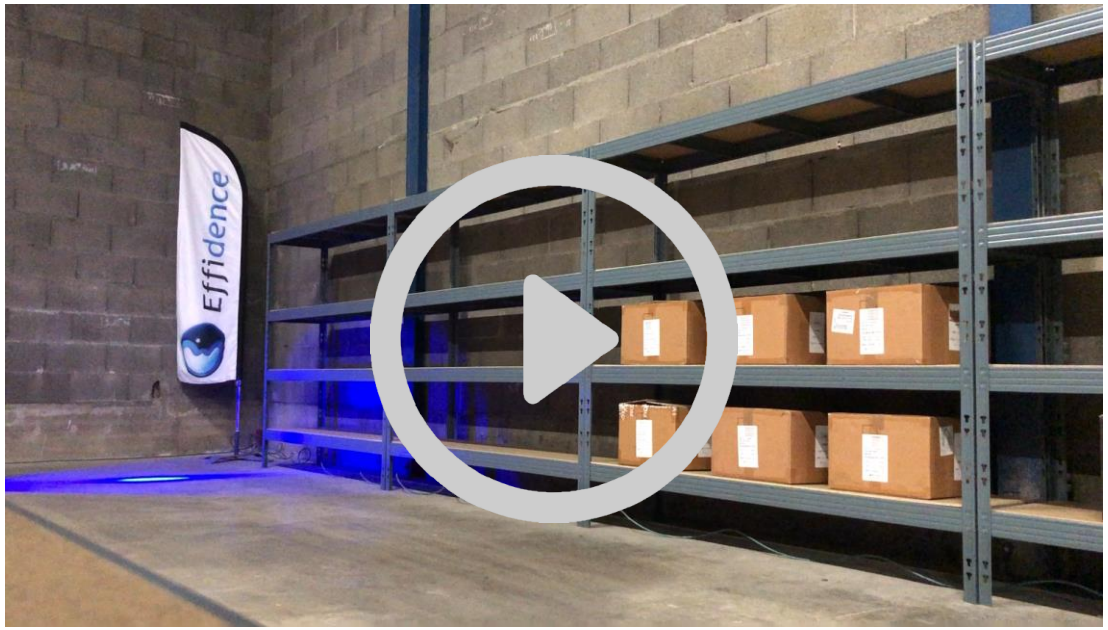
Trolley's autonomous transfert



Detection then arrival under the trolley

7 seconds

https://youtu.be/ifyHnyeaNSA



https://youtu.be/9Lj4FdUDorc

Trolley's dropping

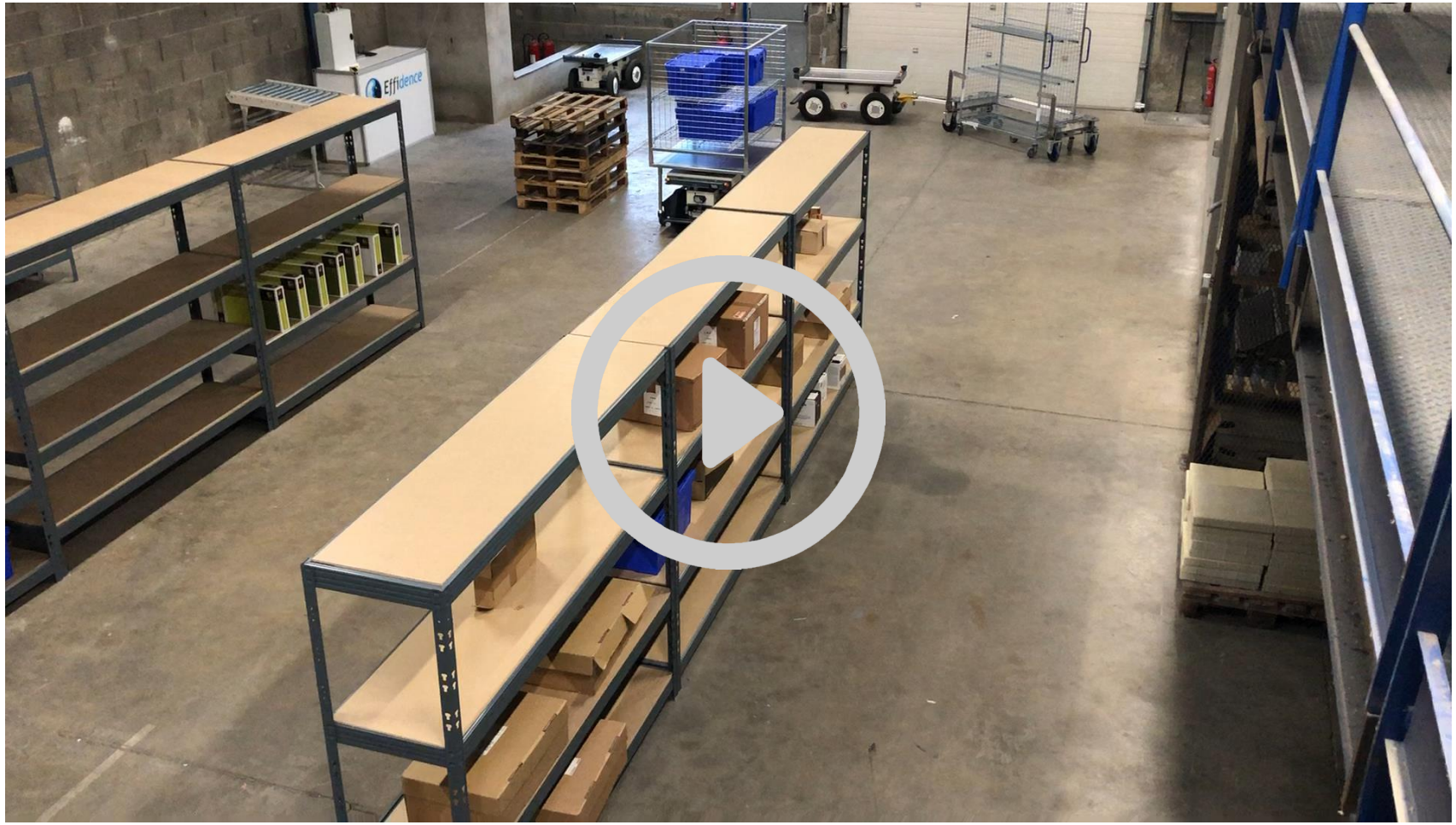
https://youtu.be/5DxGxdPMDUY

Trolley's degripping

10 seconds

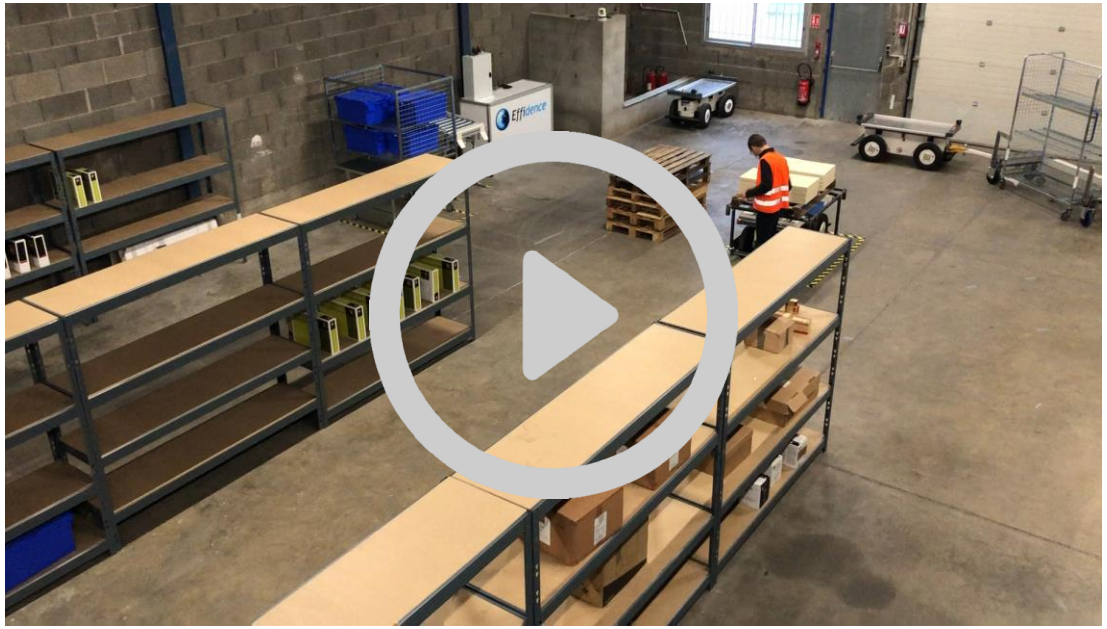
https://youtu.be/HC1wEOKOcOc

Picking assistance

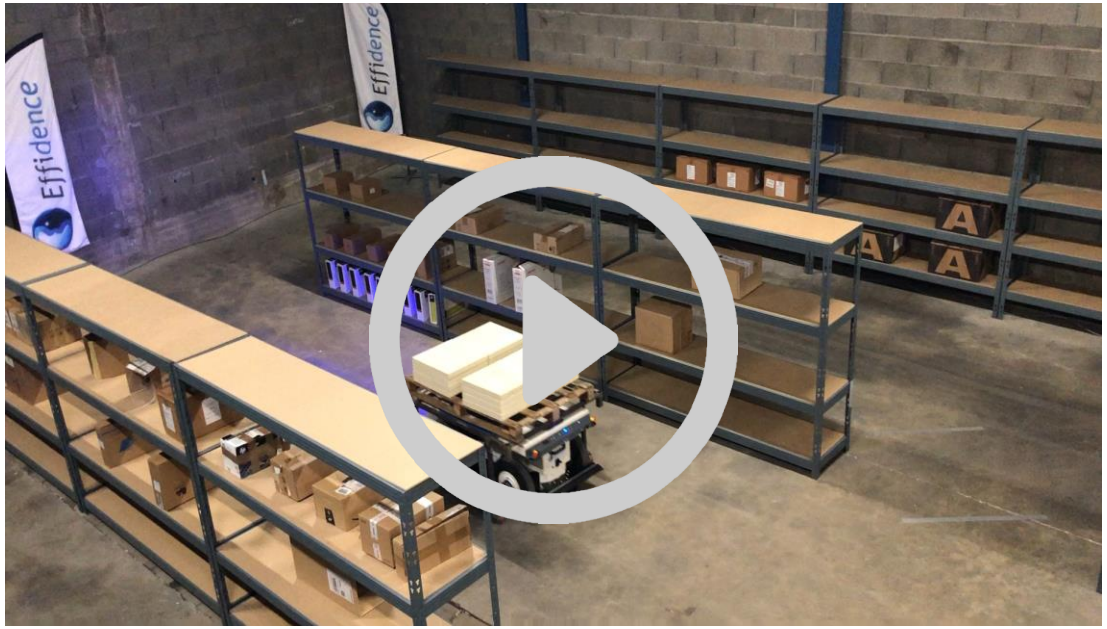


https://youtu.be/uZumC6P-BnY

Transport of heavy charges



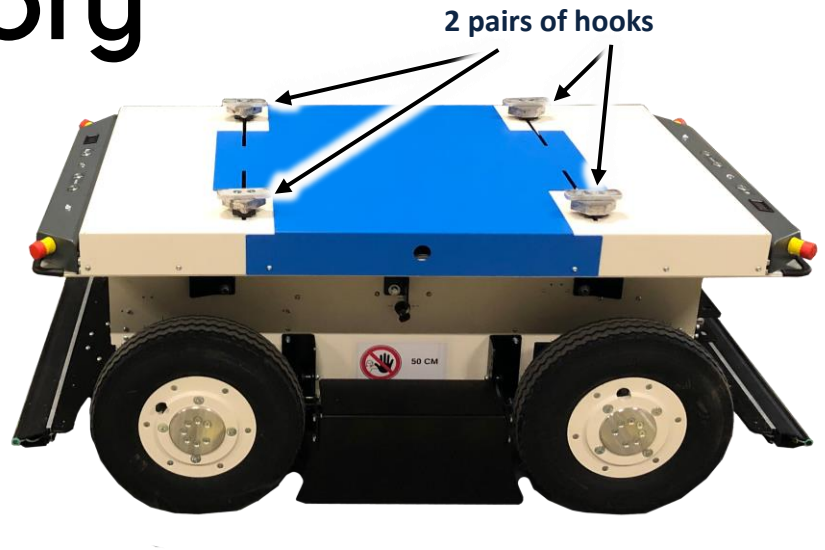
Following of an operator
https://youtu.be/ipZxuwdj-V4

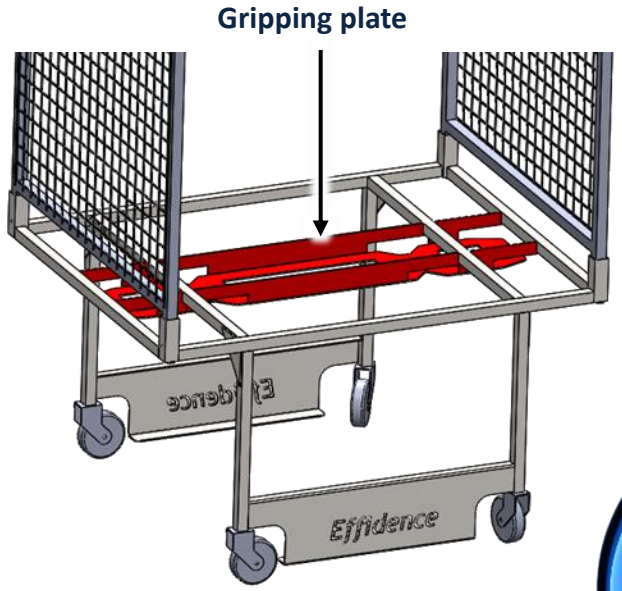


Autonomous drop of a trolley
https://youtu.be/MmYXmr4hMTk

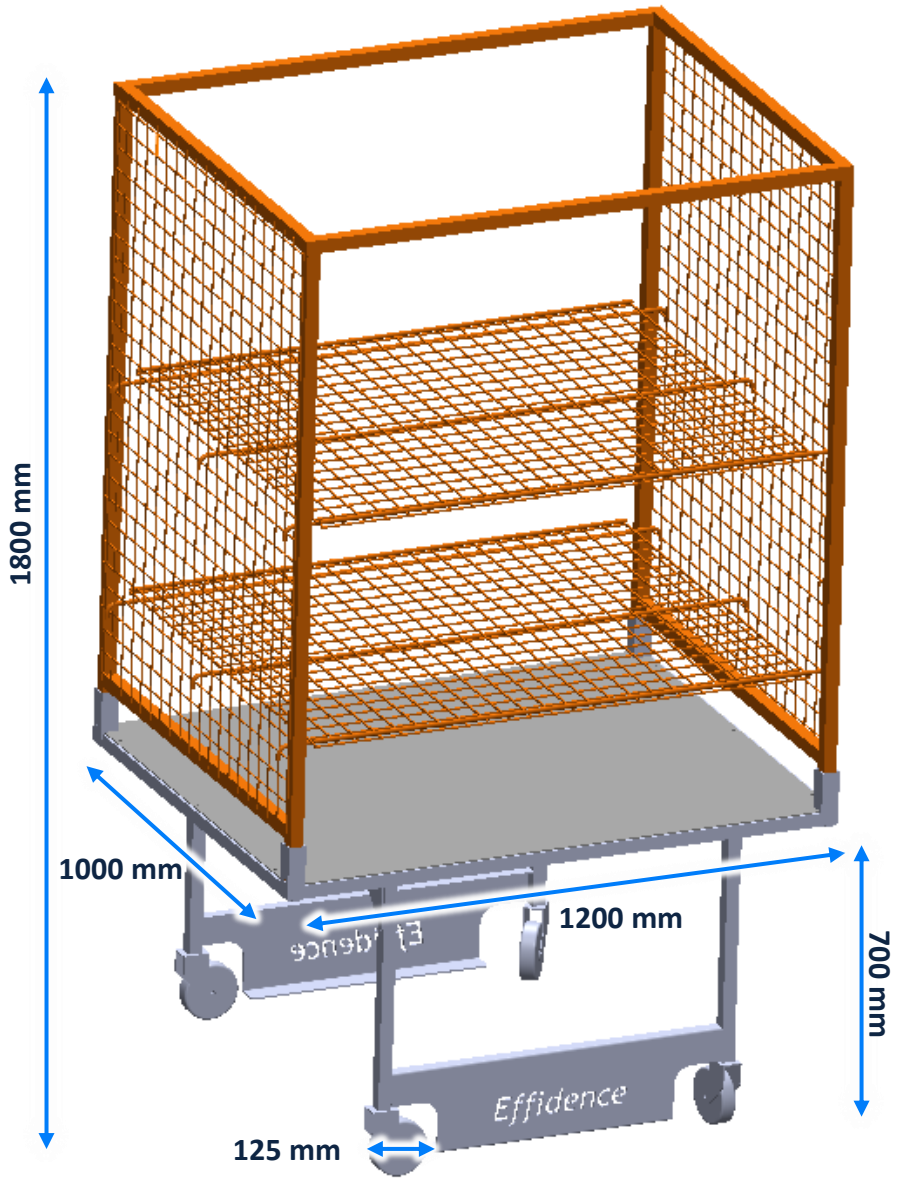
The 3D-CartGRIP accessory

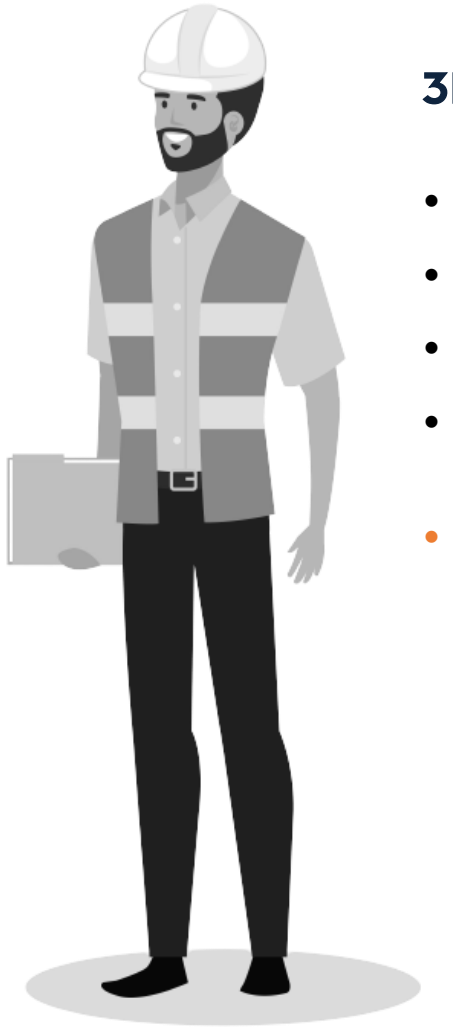
- **3D-CartGRIP** is an accessory that can be attached to the standard **EffiBOT** robot platform. It is composed of 2 pairs of hooks. The **3D-Cart** trolley is equipped with a gripping plate under its first shelf.
- **EffiBOT** goes underneath the trolley and is centred thanks to the 4 feet of the **3D-Cart**.
- **3D-CartGRIP** tightens its **2 pairs of hooks** which ensure the **precise re-centring** of the trolley, and **firmly grips** the gripping plate.
- **EffiBOT** is ready to move, **autonomously or in operator follow-up**.
- To release the trolley, **EffiBOT** loosen its hooks and leave in full autonomy.





The 3D-Cart trolley



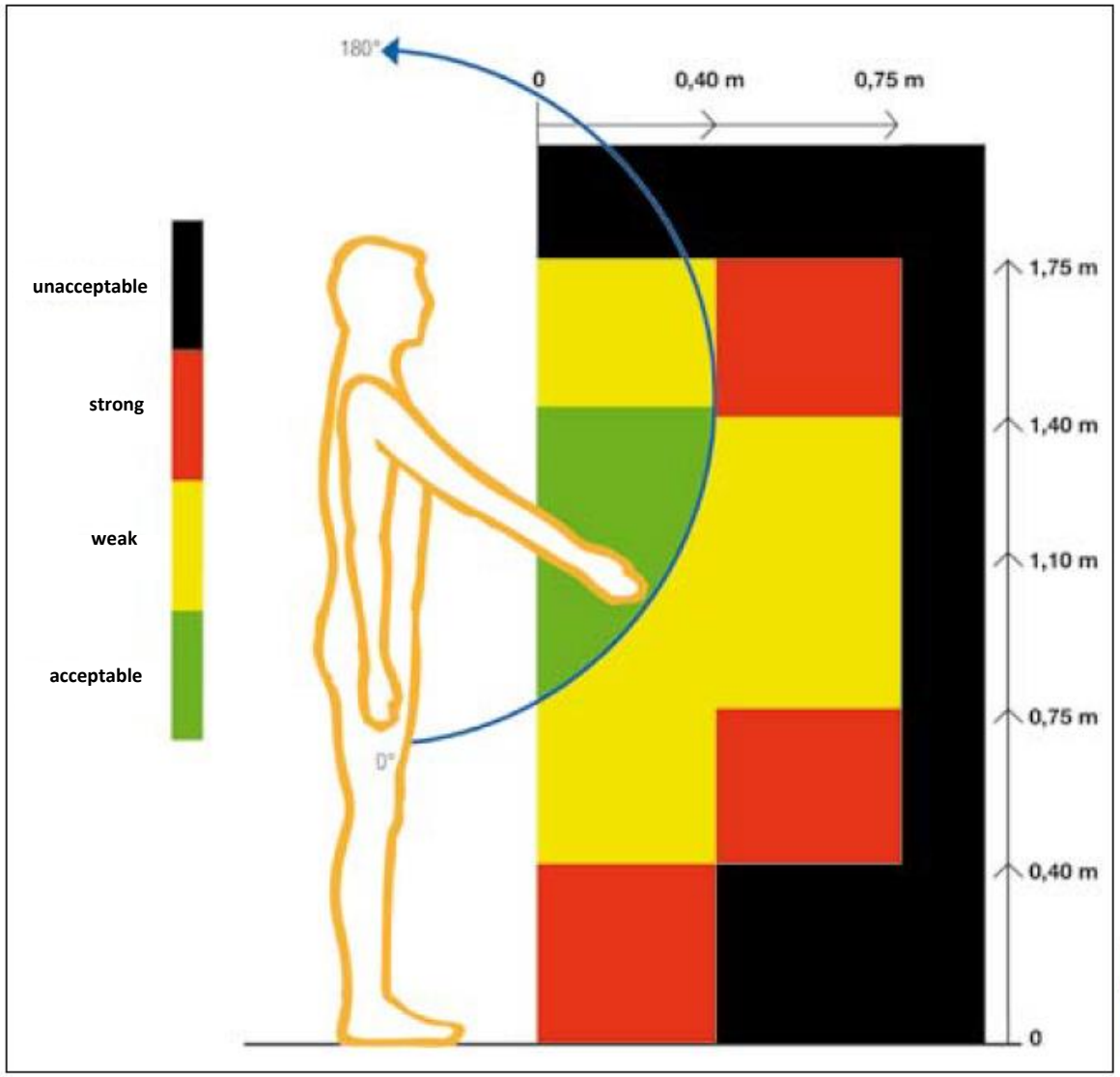


3D-Cart trolley, compatible with the **3D-CartGRIP** :

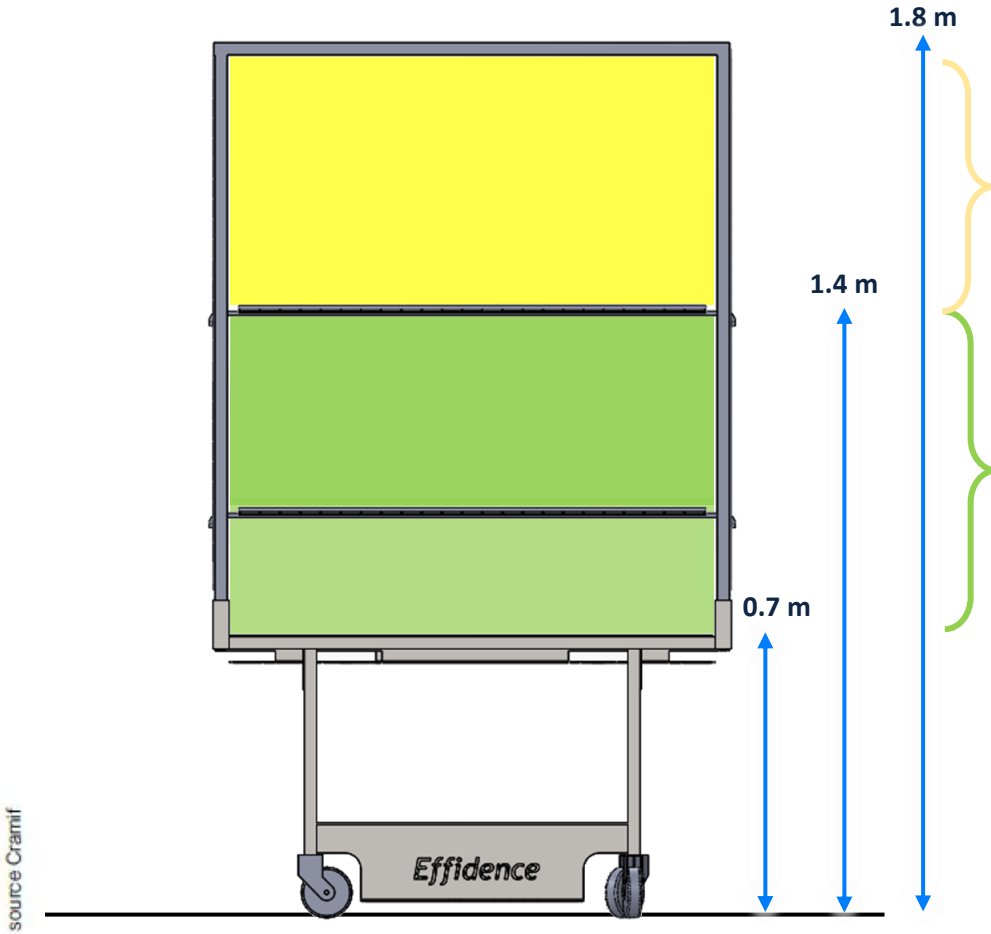
- Loading surface (Lxl) : 1200 mm x 1000 mm
- Loading volume : 1.32 m^3
- Maximum charge : jusqu'à 400 kg
- Trolley's empty weight : 80 kg

- **Equiped with a customizable upper structure**

The 3D-Cart trolley / Working height



Schematisation of the postural constraints' areas for shelving in furniture



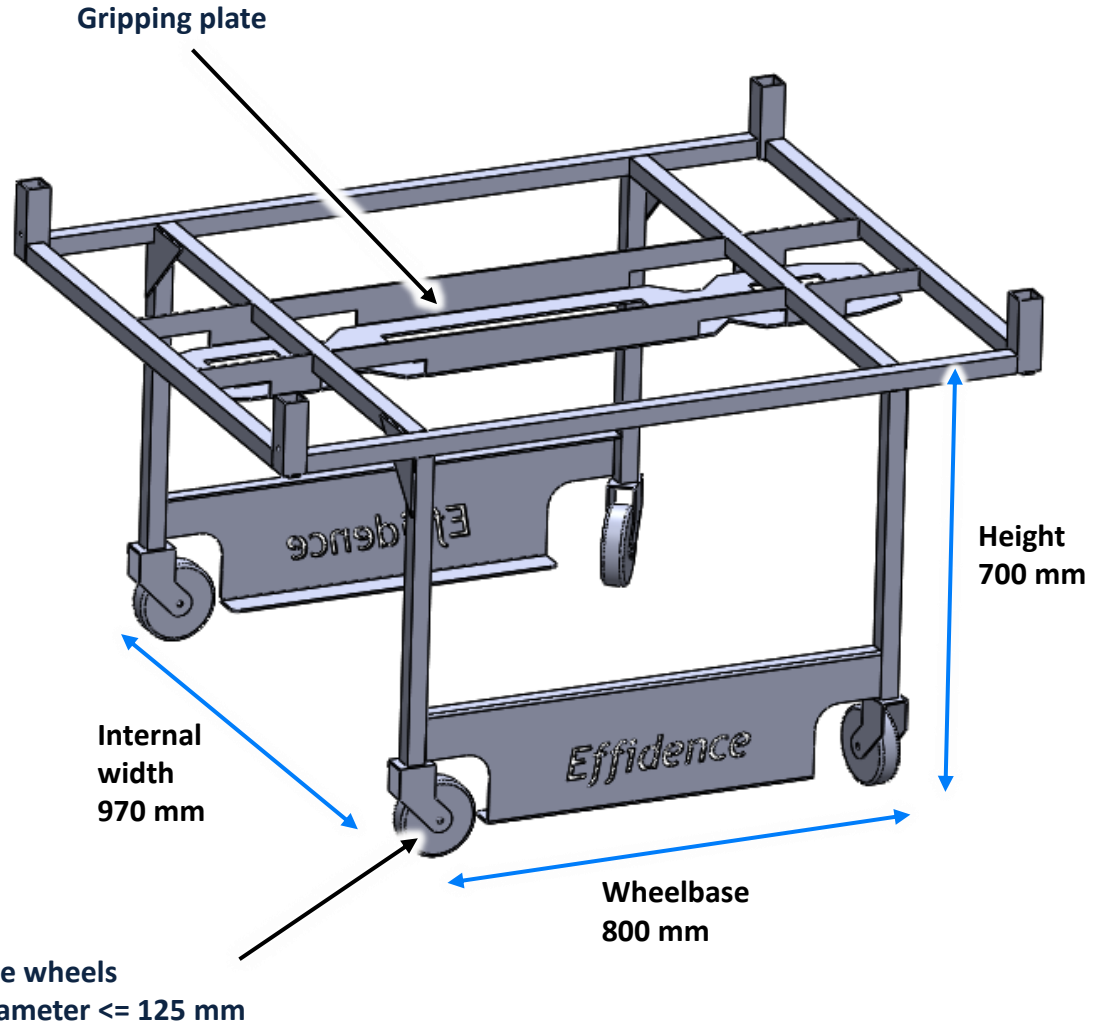
source Cramif

37 % in weak area

63 % in acceptable area

Design your own trolley!

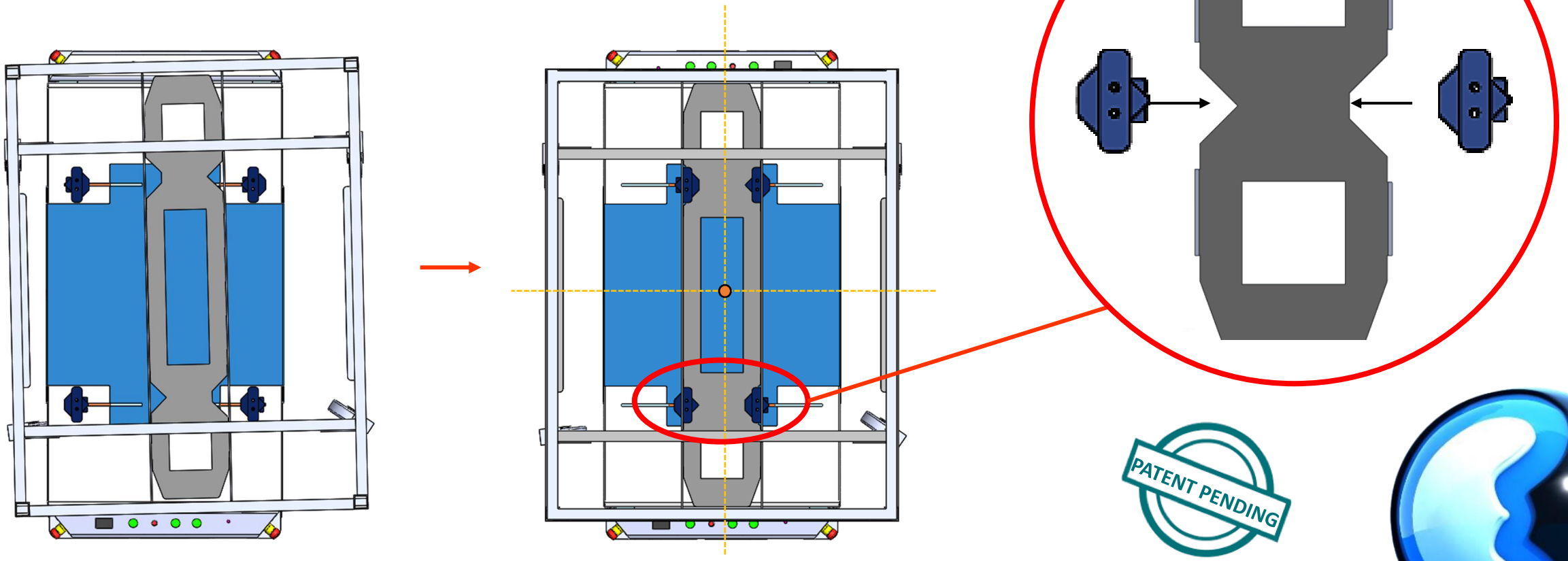
Width of the trolley depending on the diameter of the wheels and the path of arrival of the robot under the trolley



Trolley's height depending on the vertical space allowed for gripping

Smart 3D-FootPRINT technology

- **3D-CartGRIP** uses the **Smart 3D-FootPRINT** technology, which provides a unique footprint incorporated into the gripping plate attached to under the **3D-Cart** trolley. Two pairs of hooks of complementary shape to this imprint are present on the **3D-CartGRIP** accessory.



PATENT PENDING

Smart 3D-FootPRINT technology

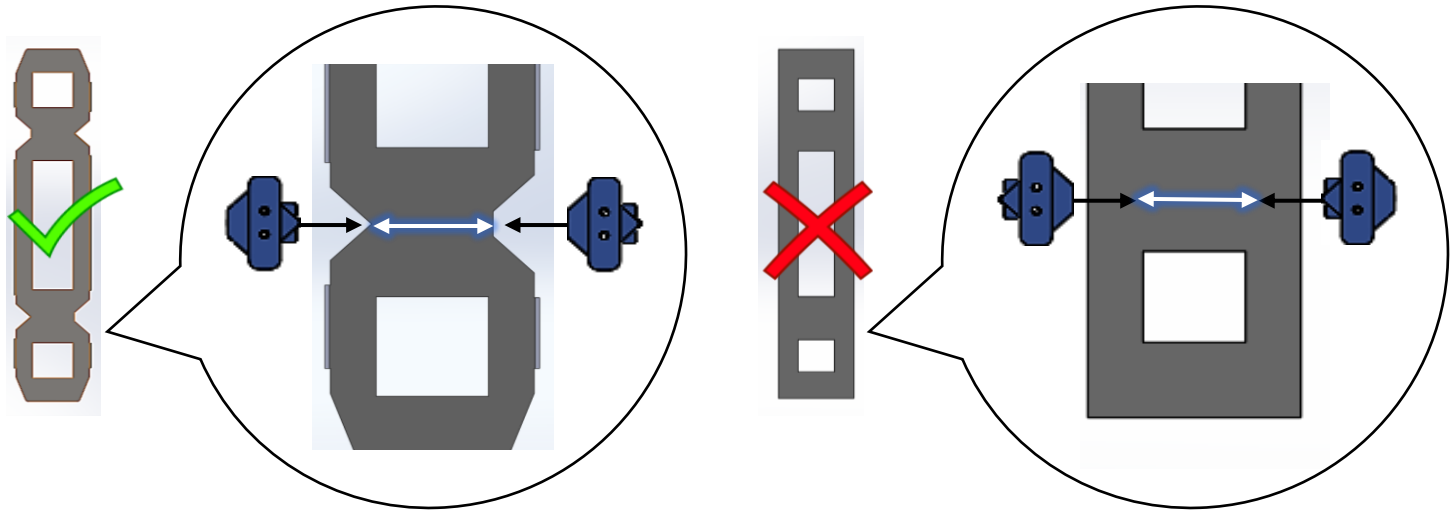
- This **Smart 3D-FootPRINT** technology allows to answer simultaneously the 3 following challenges.

	Smart 3D-FootPRINT
Reliable **3D-Cart** trolley identification	✓
Securising the gripping phase	✓
Securising the gripping of the carriage during robot movement	✓

Smart 3D-FootPRINT technology

Reliable **3D-Cart** trolley identification

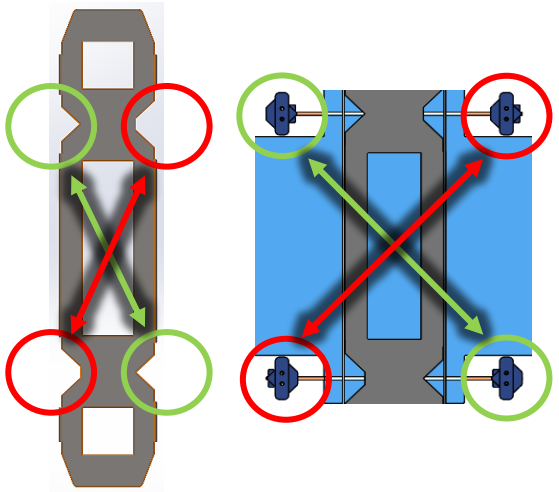
- After closing the pairs of hooks on the gripping plate, the distance between the two hooks makes it possible to uniquely and reliably identify the **3D-Cart** trolley.



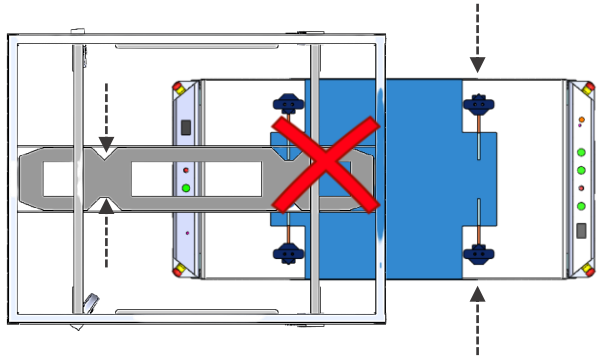
Smart 3D-FootPRINT technology

Securising the gripping phase

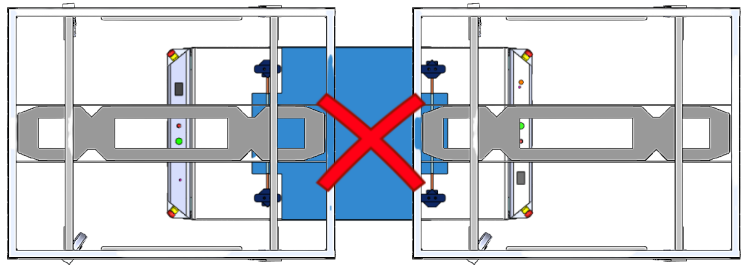
- The footprints integrated in the gripping plate prevent improper gripping. They do, however, allow gripping from the front or rear of the 3D-Cart and in forward or reverse gear of **EffiBOT**.



Footprint symmetry



Non-conform gripping detected
(e.g. the operator moves the trolley).

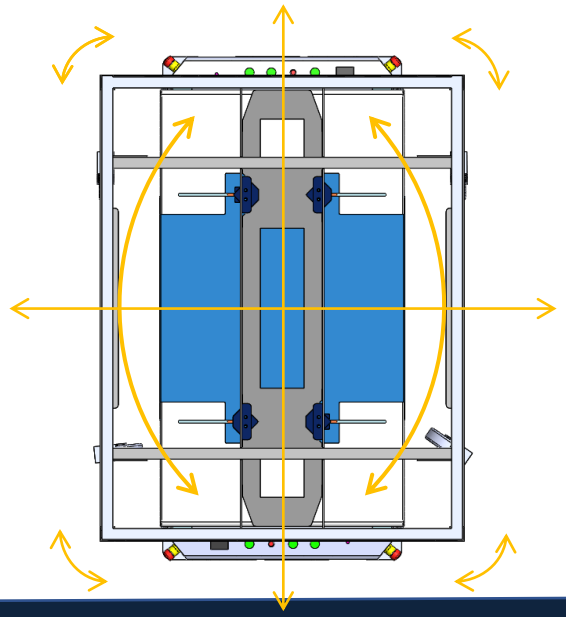


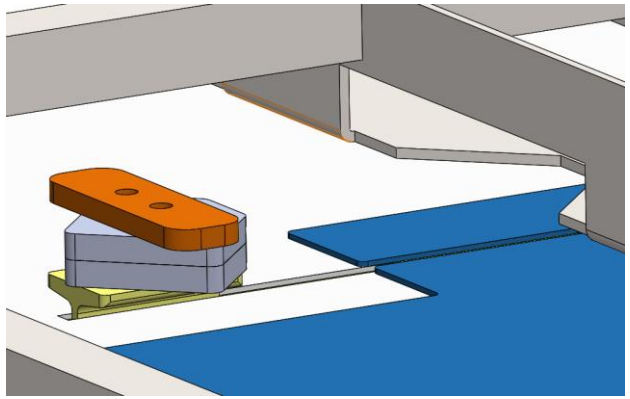
Non-conform gripping detected
(e.g.: trolleys in single file)

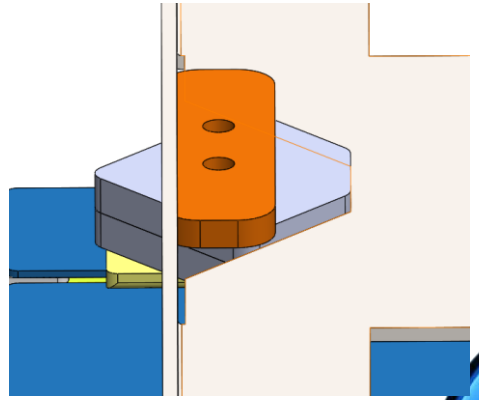
Smart 3D-FootPRINT technology

Securising the gripping of the carriage during robot movement

- Closing the two pairs of hooks on the gripping plate centres 1-laterally, 2-longitudinally, and 3-angularly the **3D-Cart** on the **EffiBOT**. These hooks also ensure a firm hold, even in the vertical (3D) position of the trolley.







3D support: vertical. The hook consists of an upper plate that prevents the trolley from moving vertically.

Safety first architecture

- The 3D-CartGRIP electronic system has been designed in accordance with **ISO 13849**: *"Safety-related parts of control systems".* It is a Category 2 safety architecture with a **performance level of SIL2 / PLd**.

- This electronic system prevents the EffiBOT from moving until both pairs of hooks are fully open or closed.

  - ✓ Redundant microcontrollers (main channel and test channel)
  - ✓ Redundant sensors with inverted logic for opening pairs of hooks
  - ✓ Redundant sensor with inverted logic for closing pairs of hooks
  - ✓ Redundant reverse logic emergency stop outputs connected to the STO input of the motors(Safe Torque Off)

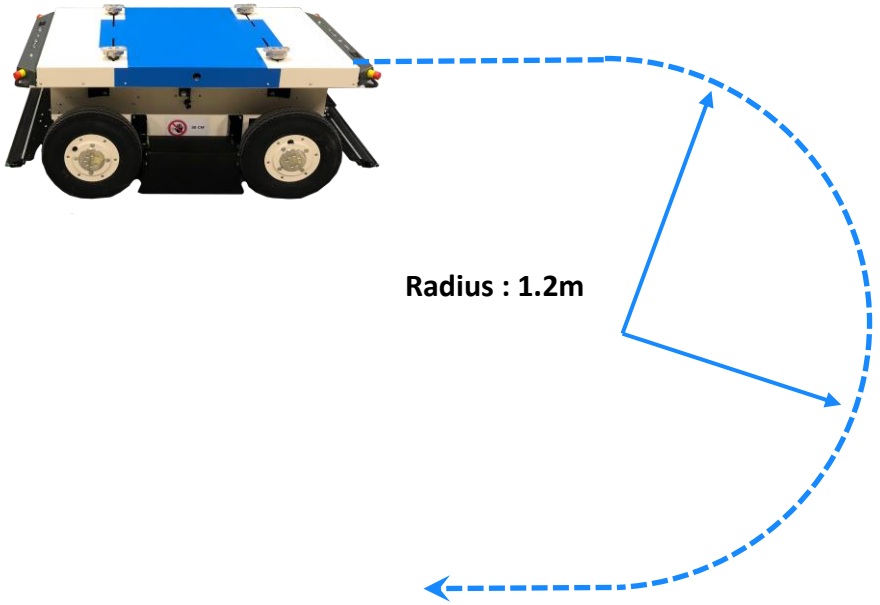
EffiBOT & 3D-CartGRIP

Obstacles perception

- When the robot **EffiBOT** is equipped with the **3D-CartGRIP** accessory, the sensors' field of view is unchanged.

- The patented mechanical design of **EffiBOT**, which retains almost the entire field of view of the 360° laser scanner, means that after the **3D-Cart** trolley is gripped, the same field of view can continue to be enjoyed. This is achieved by holding the carriage firmly when the robot is moving thanks to the **Smart 3D-FootPRINT** technology.

EffiBOT & 3D-CartGRIP



Cinematics

- When the **EffiBOT** robot, equipped with the **3D-CartGRIP** accessory, is gripped on a **3D-Cart** trolley the kinematics are unchanged. Only the width of the robotic system changes to take into account the width of the 3D-Cart carriage.

  - ✓ Max. speed (av & ar) : 2 m/s
  - ✓ Turning radius : 1.2 m
  - ✓ Symmetrical robot and bi-directional movement
  - ✓ Width : 66 cm (**EffiBOT**) / 1m (**3D-Cart**)

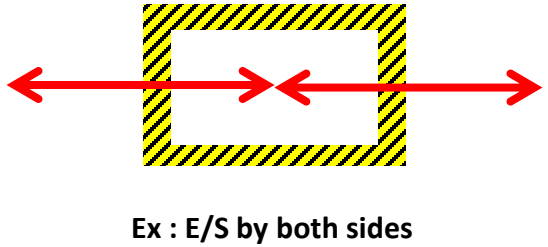
Autonomy

- The **3D-CartGRIP** accessory has no effect on the operating autonomy of the **EffiBOT**. Holding the hooks in the closed or open position does not consume any current. The use of a helical screw instead of an electric brake allows the hooks to be locked in a position without consuming energy.

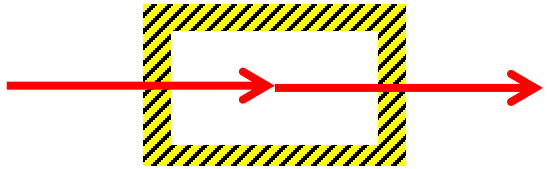
Installation

- Within the **MapEditor** mapping software, the installer locates the positions in the warehouse where the robot will pick and place **3D-Cart** trolleys. For a Lean-Manufacturing approach, it is recommended that the operators identify these areas by marking on the floor.

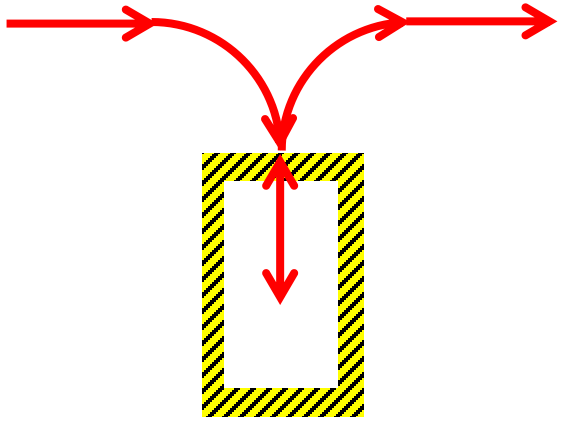
- The paths to reach these positions are plotted in the software.



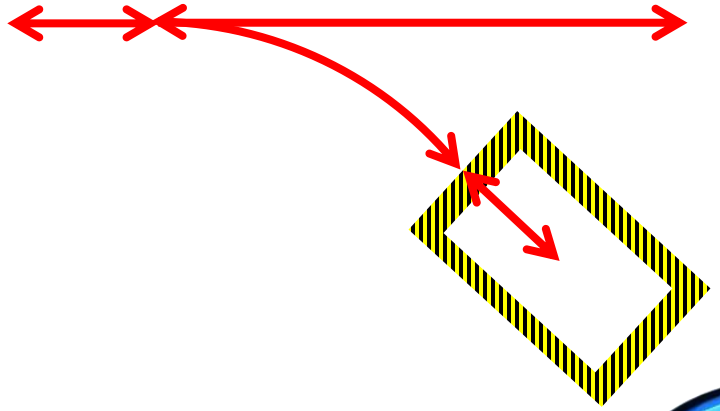
Ex : E/S by both sides



Ex : E by the left. S by the right.



Ex : perpendicular parking
E/S from the top



Ex : angle parking
E/S par la gauche

Usage

- 3D-CartGRIP can be used **with** or **without** a **float server.**

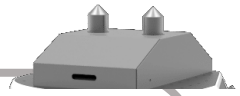
- Without server : **" standalone mode ",** EffiBOT moves in total autonomy according to the indications given in its cartography:
    - Road list,
    - navigation destination defined by zones and activated either by pressing the "Auto" button on the keypad or triggered by a timer.

- With a **"FCS mode"** server, EffiBOT moves in total autonomy according to the instructions communicated in Wifi by the server. Eventually, these instructions can come from the cartography.

- If EffiBOT reaches a deposit destination, it will open its hooks when it reaches its destination.

- If EffiBOT reaches a pickup destination, it will attempt to locate the 3D-Cart as it approaches the destination. This recognition is based on detecting at least 3 feet from the trolley (checking the width of the feet and their spacing). If no cart is present, EffiBOT will park at the destination. If a 3D-Cart is recognised, EffiBOT will position itself in the centre of the cart and close its hooks.

Synthesis



	Other products	3D-CartGRIP
Useful volume	~0.50 m³ *(a)* 0.63 m³ *(b)* 0.87 m³ *(c)*	**1.32 m³**
Useful charge – Speed	68 kg – 1.5 m/s *(a)* 130 kg – 0.9 m/s *(b)* 270 kg – 1.2 m/s *(c)*	**200 kg - 2m/s**
Controlled emergency trajectory	4 idle wheels Robot mass < 100kg	**4 steering wheels, braked** **Robot mass 140kg**
Reliable identification of the **3D-Cart**	✗	✓
Securising the gripping phase	✗	✓ SIL2 Functional Safety PLd
Securising of the trolley's suspension system	✗	✓ SIL2 Functional Safety PLd
Follow-me 360° function	✗	✓

(a) Fetch CartConnect, (b) Omron CartTransporter, (c)MIR Shelf Carrier

Effidence

Intelligence for mobile robotics

www.effidence.com/en/

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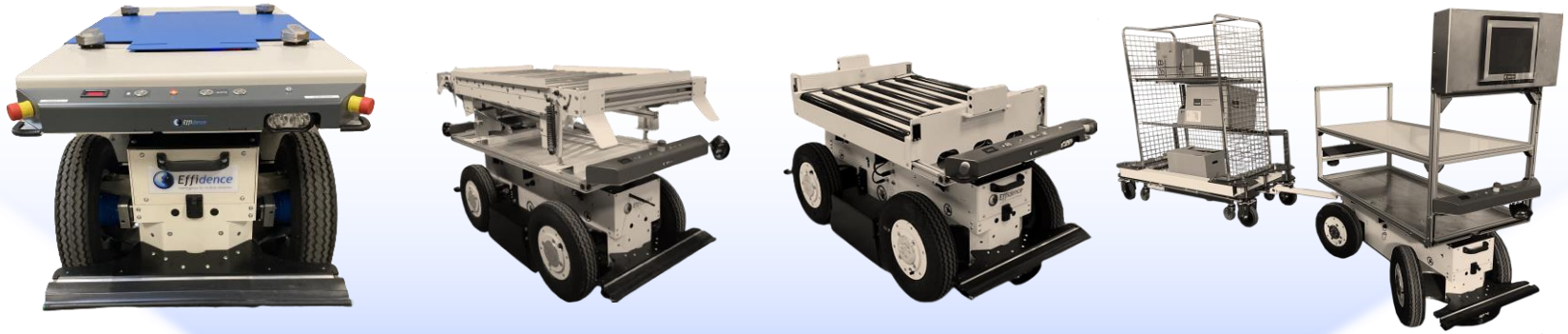

3D-CartGRIP