

# MER

Manipulation Enhancement through Robotic Guidance  
and Intelligent Novel Grippers

# GING



A European project that aims at creating a robotic platform that can manipulate soft materials in industrial environments, by pioneering new robotic gripper and technologies with application of artificial intelligence



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The MERGING project aims to provide manufacturers with a versatile, easy-to-use and low-cost solution to automate or assist the handling of flexible and fragile objects. By addressing challenges such as handling of **soft materials** using robots, developing handling devices which are **intelligent and universally dexterous**, and making future robots capable of handling soft products while **controlling their level of deformation**, it will lead to disruptive innovations in many sectors.

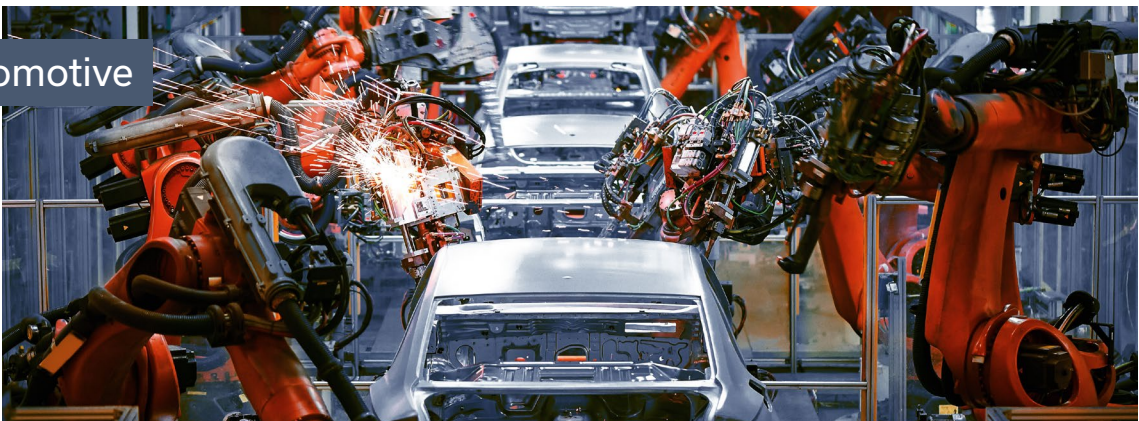
Textile and garment industry



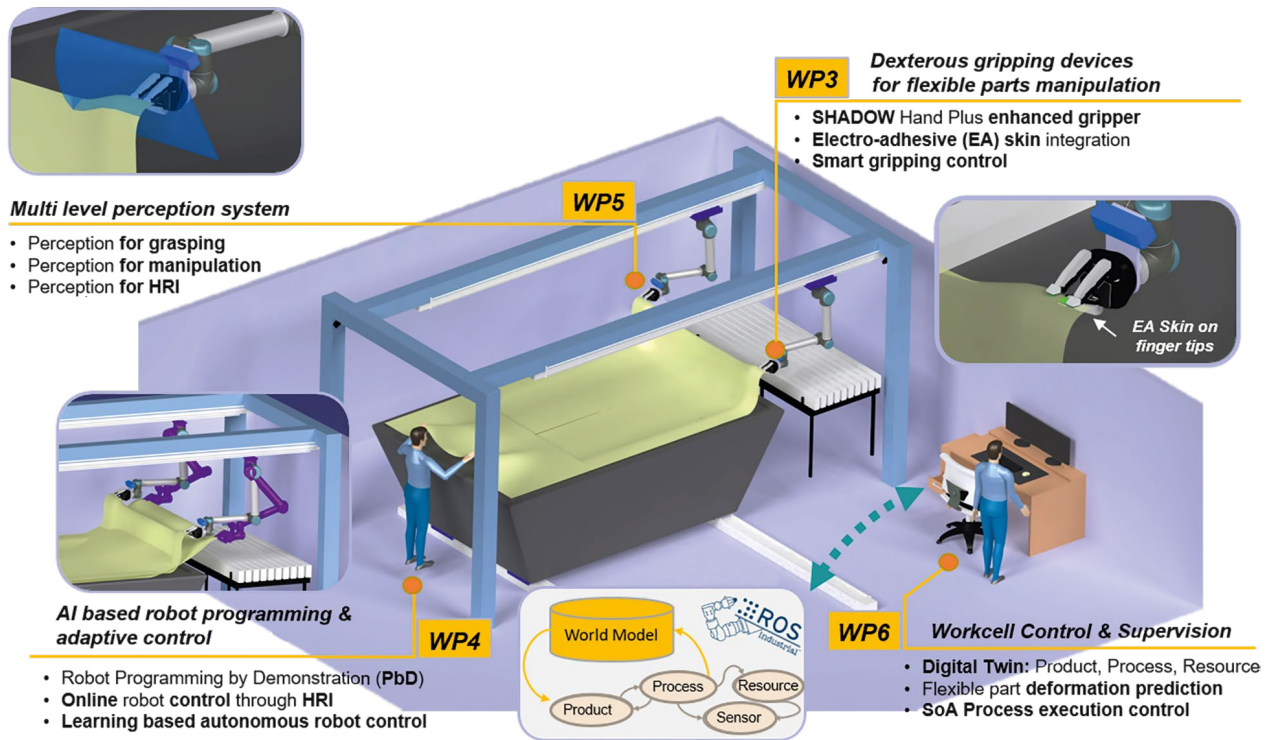
Food packaging



Automotive



# The MERGING building blocks



## Dextrous gripping devices for flexible part manipulation

Integration of a multi-finger gripper equipped with an electro-adhesive skin that conforms to the objects to handle them without damaging them.

## Multilevel perception system for environment understanding

Perceiving and recognition of human presence and activity, and other obstacles, and reasoning upon them — implementing a multi sensor approach for the detection of flexible parts and their manipulation monitoring.

## AI based robot programming and adaptive control

Easy robot programming by manual demonstration, Human-Robot collaborative manipulation of large parts involving human intention prediction; learning-based autonomous control of the robot to adjust its behaviour based on the object and environment status.

## MERGING workcell control & supervision

Communication and coordination among different kind of resources (robots, grippers, humans); flexible part deformation prediction; combination of the different sensors / sources of information for building a common scene (digital twin) to be used for decision making and robot behaviour adaptation.

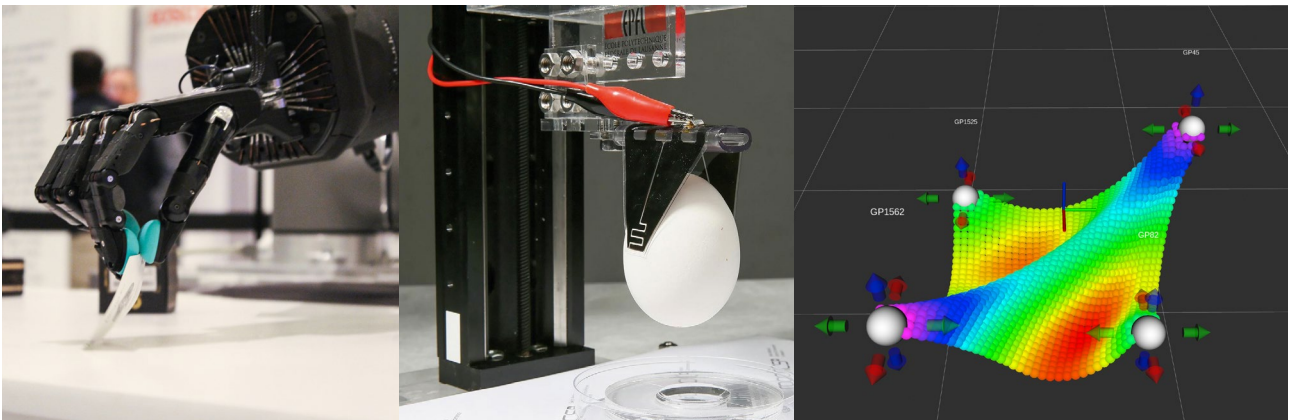
## Concept

Current robots are mostly used for industrial applications, where they handle rigid objects and interact with them in repetitive operations. But a big part of the European and global industry is comprised of sectors where soft and flexible items are manipulated. Take for example the fabrication of garments, shoes or lingerie; the processing, canning, packaging or manipulation of food, and all sort of tasks in retail; the manipulation of glass fibre and carbon fibre fabrics for the manufacturing of composite parts of vehicles. All these materials do not behave in an entirely predictable way, due to their high flexibility, and can be easily damaged. Grasping and manipulating them requires a gentle grasp, fine and adaptive control of movements that is beyond the current state of the art in robotics.

The ambition of the MERGING project is to overcome these challenges and provide manufacturers with a turnkey robotic solution for such tasks.

It will consist of a **dexterous gripper** equipped with an adaptive **electro-adhesive skin**. Electro-adhesion will increase the attraction forces between the gripper fingers and the object. The skin will also have ability to conform to the objects to handle in order to rise the contact surface.

The autonomous robot behaviour will be empowered by supervision functions and real-time workcell representation, based on perception data and modelling.



Three initial inspiration solutions to be merged into the MERGING platform: (left) Shadow Dexterous Hand, (center) EPFL's soft gripper based on electroadhesion, (right) flexible material modelling for robotic handling

We will carry out proof-of-concept studies in three different applications and sectors: fabric handling for lingerie manufacturing, technical fiber handling for composite panels for the automotive industry, plastic pouches handling for the packaging in food industry.

## Pilot case 1 Manipulation for lingerie manufacturing

The use-case addresses the manufacturing of women lingerie, with the manipulation of fine textile parts during critical process steps, in particular the thermoforming process.



Key steps of the lingerie manufacturing process

## Pilot case 2 Manipulation for food packaging

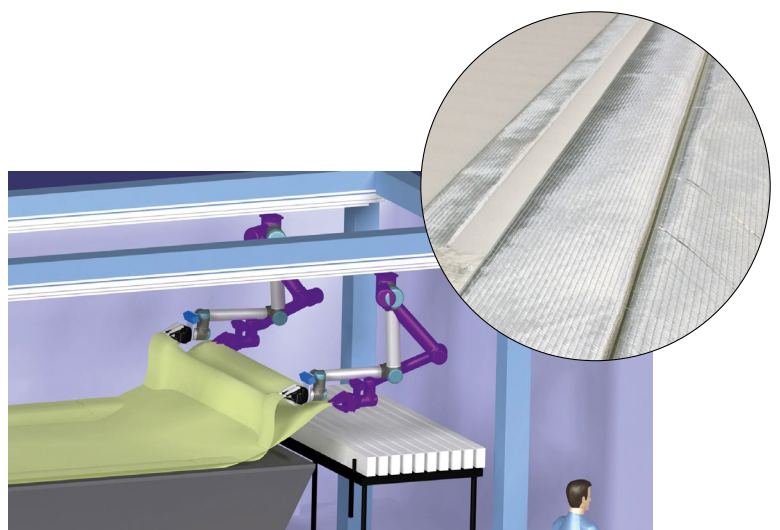
Here we address the food packaging market, and more specifically the handling of soft plastic pouches. Empty pouches are manipulated for bin picking and placing into the input machine. Already filled pillow pouches are manipulated for optimal stacking into a transportation flexible bag.



The plastic pouches manipulated in the pilot case and the machinery where they have to be placed for filling

## Pilot case 3 Manipulation for composite manufacturing

This case addresses challenges in the lay-up manufacturing process of automotive panels. Currently, this process consists in a series of manual operations of flexible glass fiber (GF) textiles in addition to foam blocks. The envisioned solution proposes a hybrid cell where humans and robots collaborate in fenceless environment.






The envisioned hybrid cell for flexible glass fiber for composite parts manufacturing

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