**Input modulo SIM**

* Environments description (from PEM)
* High-level understanding of environment - list of objects (static, dynamic of human type, dynamic of non-human type) of the environment with their features
  + UUID
  + Past, current and predicted features
    - Timestamp
    - 3D physical description (shape, size, position, orientation)
    - Semantic description
* Sensory data (from ISIM)
  + Image from 2D color frame-based camera (showing human operator eyes)
* Effectors state (PIM: unità di controllo)
* Hardware state (Are these data required by SIM for analysis of human-robot collaboration?)
* State
* Positions, velocities, accelerations and forces of arm, and forces and torques at the end-effector
* Positions, velocities, accelerations and forces of hand
* Tactile information, temperatures from hand

**Other software:**

* Grasping strategies T6.7
  + Examples: {grasping\_type, xyz (grasping\_position), time\_to\_lift} 🡪del robot!
* Human Behavior Analysis T5.3
  + {grasping\_type; grasping\_position; body\_posture} 🡪 dell’umano!
* Neuromorphic Sensing T6.2
* Fatigue Analysis

**Output modulo SIM**

* Human worker parameters and intention (to HICEM)
* Corrections to the robot's grasp and movement
* Enhanced description of human related elements of environment (dynamic objects of human type)
  + human motion characteristics (hand, body parts, tools), as 3D profiles of velocity and acceleration (expressed symbolically)
  + extended prediction of motion characteristics (obtained from analysis of human action goal)
  + engagement level
  + cognitive load level
  + identified gaze pattern
  + identified grasping strategy
  + identified mood
  + worker's reaction time
* Identified gesture commands (user requests)

**Input modulo SEM**

* Emergency interface state (from ISIM)
  + State of Emergency Interface
* Environment dscription (from PEM)
  + High-level understanding of environment - list of objects (static, dynamic of human type, dynamic of non-human type) of the environment with their features
* UUID
* Past, current and predicted features
* Timestamp
* 3D physical description (shape, size, position, orientation)  🡪 Safety Risks other Objects T4.3
* Semantic description
* Progress and results of action (from LOCEM)
  + Progress and result of requested emergency action

**Other Software:**

* Human Posture analysis T4.5
* Neuromorphic Sensing T4.4

**Output SEM**

* High level emergency and ergonomics commands (to HICEM)
* High level and high latency emergency and ergonomics instructions
  + Type of action to be performed by robot (movement, grasp, stopping)
    - Type of action or only conditions to be imposed on currently performed actions (e.g., pace of work)
* Comprehensive description of the goal for the movement action (description composed of numerical parameters of goal and semantic information)
* The reason behind emergency instructions (description of the problem and the mitigation)
* Feedback regarding safety and ergonomics to be indicated to human worker (From GA: implicit communication necessary to be transferred to the operator before the robotic actions is performed)
* High level emergency commands (to LOCEM)
  + High level and low latency emergency instructions
    - Type of action to be performed by robot (movement, grasp, stopping, corrections)
    - Comprehensive description of the goal for the movement action (description composed of numerical parameters of goal and semantic information)