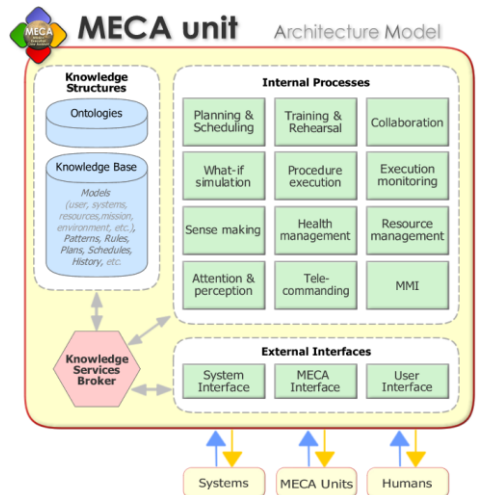
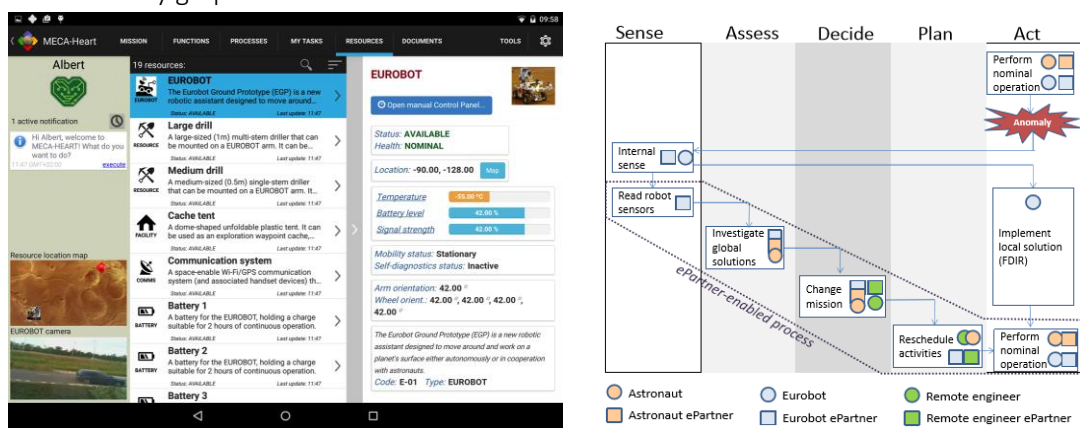


Users	Software developers for CPSs that require human interaction.
Key Features	<ul style="list-style-type: none"> • Modular and extensible framework for projects related to human-machine interaction. • Integrated decision-making support. • Allows autonomous CPSs alone. • Provides situation awareness execution for CPSs.
Benefits for the User	<ul style="list-style-type: none"> • Enables fast prototyping for human-machine applications. • Allows customers to solve more complex problems with the human in the loop. • Increases the efficiency of human-robot teams.
Inputs	<ul style="list-style-type: none"> • High level model describing the actors' capabilities. • Interfaces for commanding CPSs.
Outputs	<ul style="list-style-type: none"> • Plan for coordinated execution for the human-robot team. • Explanation of the decisions made by the system.
Block Design	<p>A MECA deployment is composed as one or more MECA units interconnected (typically one per CPS). Each unit provides decision support and situation awareness.</p>  <p>The diagram shows the MECA unit Architecture Model. It consists of several interconnected components: <ul style="list-style-type: none"> Knowledge Structures: Includes Ontologies and Knowledge Base (Models: user, systems, resources, mission, environment, etc., Patterns, Rules, Plans, Schedules, History, etc.). Internal Processes: A grid of processes including Planning & Scheduling, Training & Rehearsal, Collaboration, What-if simulation, Procedure execution, Execution monitoring, Sense making, Health management, Resource management, Attention & perception, Tele-commanding, and MMI. External Interfaces: Includes System Interface, MECA Interface, and User Interface. Knowledge Services Broker: A central hub connecting the Knowledge Structures and Internal Processes. Interactions: Bidirectional arrows connect the MECA unit to Systems, MECA Units, and Humans. </p>
Example of Usage	<p>MECA has been deployed in an astronaut-Eurobot team for planetary exploration tasks, allowing the astronaut to cooperate with the robot in order to achieve different cooperative tasks such as samples collection or payload deployment. The interaction is done using a tablet with a friendly graphical environment.</p>  <p>The screenshot shows the MECA-Heart tablet interface with various mission-related information, including resources, tasks, and system status. The process flow diagram illustrates the interaction between the Astronaut and Eurobot through the MECA system, following the Sense-Assess-Decide-Plan-Act cycle. Key elements include: <ul style="list-style-type: none"> Sense: Internal sense and Read robot sensors. Assess: Investigate global solutions. Decide: Change mission. Plan: Reschedule activities. Act: Perform nominal operation (with an Anomaly) and Implement local solution (FDIR). The diagram also shows the ePartner-enabled process involving Astronaut, Eurobot, Remote engineer, and their respective ePartners. </p>

Role in the Toolchain	MECA is the interface between CPSs and the user, allowing the user to be part of the system-in-the-loop.