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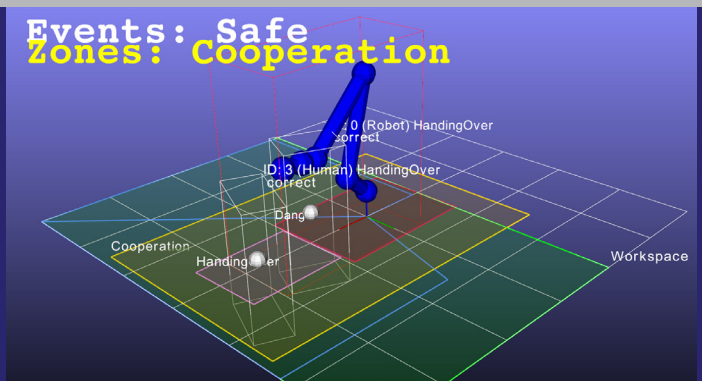

DYNAMIC SAFETY CONCEPT FOR HUMAN-MACHINE-INTERACTION

Flexibility and efficiency in safe Human-Machine-Interaction (HMI)

The system, which has been developed by Fraunhofer IWU, offers the possibility to design the HMI work process flexibly and efficiently, in addition to real-time work space monitoring.

HMI applications are categorized in four levels of interaction. In each level the following is defined:

– how many safe or dangerous zones there are, and how many interaction zones,
– which properties they have (shape, size, statics, dynamics etc.),
– who (robot/human) is allowed to enter these zones,
– which types of robot control and speed apply,
– which human characteristics have to be detected in the close-up range and the far range.

Redundant sensor concept and zone-based robot control

For monitoring the HMI application a redundant camera system is used that observes the work space from different perspectives. By fusing and plausibility of the sensor data, errors are registered by the system, for example covering of the human by the robot. In addition to the center of gravity and the size of the human body, individual body parts (hand, head) are recognized. Using an extensive modular system, an individual concept (hybrid vision-/force-robot control) can be developed for each HMI application. Zone-based robot control is used for the HMI process. For this reason, a robot can detect several humans in a single work environment and interact with them differently.

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