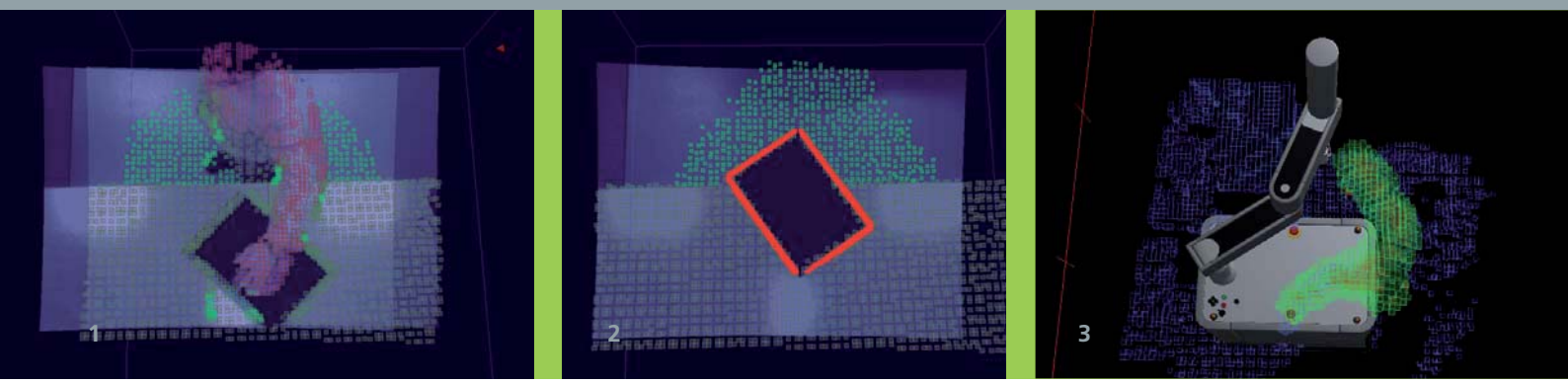
Fraunhofer
IFF

FRAUNHOFER INSTITUTE FOR FACTORY OPERATION AND AUTOMATION IFF



1 *Workspace scanning with a combined stereo and time-of-flight system.*
2 *Fusion of stereo and tme-of-flight measurement data.*
3 *A real human and a virtual robot.*

WORKSPACE MONITORING AND DYNAMIC SAFE AREA PLANNING

Fraunhofer Institute for Factory Operation and Automation IFF

Prof. Michael Schenk

Sandtorstrasse 22
39106 Magdeburg
Germany

Contact
Robotic Systems Business Unit
Dr. Norbert Elkmann
Tel. +49 391 4090-222
norbert.elkmann@iff.fraunhofer.de

www.iff.fraunhofer.de

Flexible Production through Safe Human-Robot Interaction

Development in subareas of production and manufacturing is moving toward maximum flexibility, high throughput and great diversity of variants. This requires adaptive production systems that maximize efficiency. The utilization of different forms of intelligent and even mobile robots such as assistance systems is one response to demand for increasingly flexible production environments.

Objectives of the Project

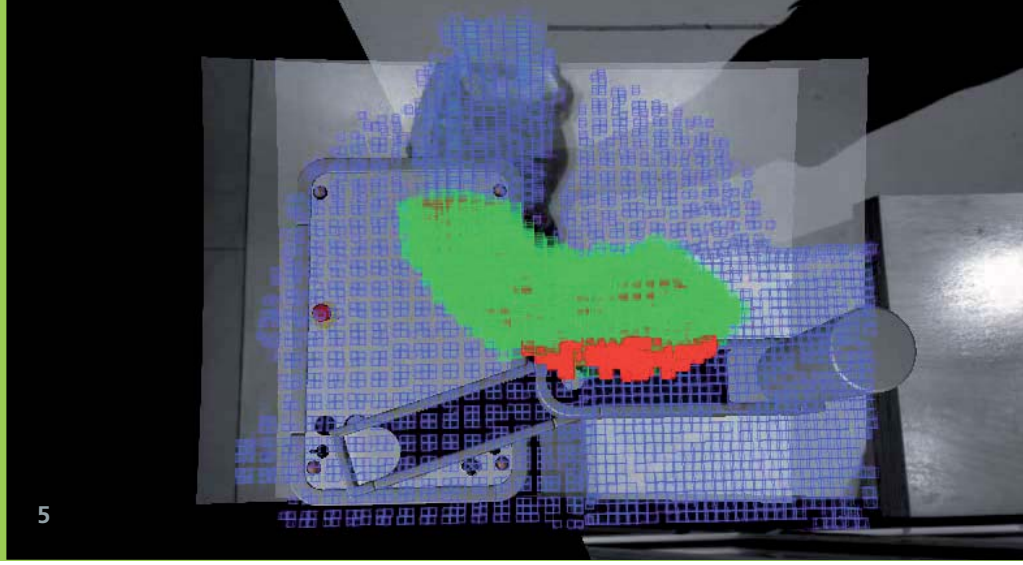
The coexistence of humans and robots and their physical interaction in a shared workspace are an integral part of adaptive and flexible production. Guaranteed safety is a basic prerequisite for this. Robots must definitely be unable to harm humans. The avoidance of robot collisions with individuals is a strategy conducive to such goals.

New Algorithms and Sensor Systems

This project is developing new methods and technologies that safely detect objects such as people in a robot's workspace. A robot reacts accordingly by reducing its speed or changing its path. This necessitates reliable sensing of people and other objects or obstacles in a robot's workspace under the widest variety of ambient conditions. A multi-sensor system has been developed, which consists of a combination of time-of-flight depth sensors and conventional stereo cameras with novel algorithms for data evaluation and fusion. Other foci have been the dynamic planning of safe and danger zones in workspaces, their monitoring and robot reactions when objects or humans approach. Contingent on the

rs_02_10_01_eng

4



5

robot's position and the concrete subsequent work step, the planning process facilitates establishing effective dynamic safe areas. This technology may be applied to many different robot configurations and factors in the implemented sensors' limitations, e.g. visibility and masking problems.

ViERforES is being funded by the Federal Ministry of Education and Research in its IKT2020 program focused on Virtual and Augmented Reality and supported by the project sponsor Software Systems and Knowledge Technologies at the German Aerospace Center.

ViERforES
Virtual and Augmented Reality for Maximum Embedded System Safety, Security and Reliability

Subproject 1: Flexible Production through Safe Human-Robot Interaction

The majority of microprocessors manufactured throughout the world are installed in embedded systems, from household appliances to commercial aircraft. Many everyday devices we take for granted fall into this category. Embedded systems have tremendous technical and economic significance. They are never stand-alone systems. Instead, they have diverse communications relationships with other systems on various levels, e.g. mechanical, hydraulic, pneumatic and electronic systems or information systems. These systems largely determine the properties of safety, security, reliability and availability. They are crucial to competition in the automotive, medical, energy, manufacturing and material handling sectors where they are applied.

This project is intended to increase the safety, security and reliability of complex technical systems by linking methods and technologies with these applications.

GEFÖRDERT VOM

Bundesministerium
für Bildung
und Forschung

BETREUT VOM

DLR
Projektträger im DLR

For more information on the joint project ViERforES, visit www.vierfores.de.

ViERforES

For more information on this topic, visit www.rs.iff.fraunhofer.de.

4 *Overlay of the system's optical sensor components.*
5 *Time deterministic collision test.*