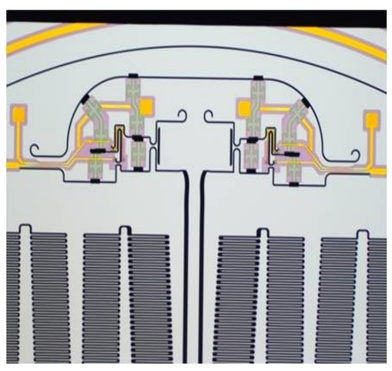
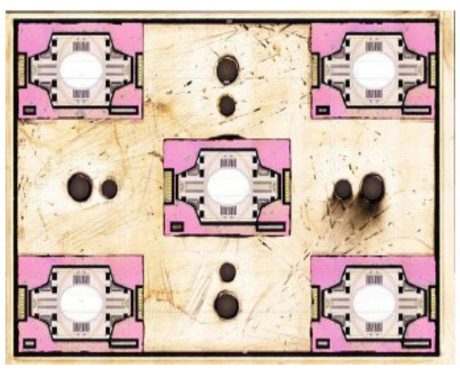
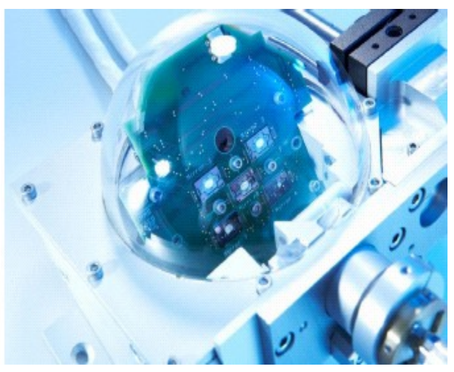
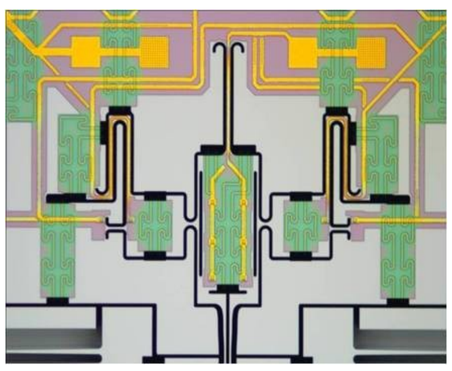
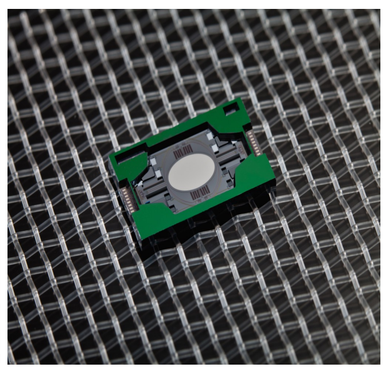
Project number: **248623**
Project website: **www.taco-project.eu**
Project start: **1 February, 2010**
Project end: **31 July, 2013**
Project duration: **42 months**
Total cost: **4.791.835.-**
EC contribution: **3.572.000.-**

TACO

Three-dimensional Adaptive Camera with Object Detection and Foveation


Mission of TACO

TACO's main goal was the development of a **3D sensing system** with real **3D foveation properties**, endowing service robots with a higher level of real time affordance perception and interaction capabilities with respect to everyday objects and environments.

In particular, the mission of the TACO project focused on:

- Enhancing the abilities of service robots by improving the sensing system with real 3D foveation properties.
- Developing a 3-dimensional sensing system with real 3D foveation properties to increase the ability for the service robot interaction with their everyday environment in a more natural and human-like manner.

The TACO sensor was developed through two main technologies: flexible, and robust hardware based on laser scanning technology on the one hand, and software for rapid object detection and environmental understanding on the other hand.

The 3D foveation properties were achieved by utilising the power of micro-mirror MEMS technology combined with state-of-the-art time-of-flight methods to ensure a system that was easily mounted on an ordinary-sized service robot or even a robot arm. The project explored control strategies for 3D foveation allowing 3D robot vision that was adaptable with space- and time-variant sampling, processing and understanding. Furthermore, the project verified and tested the 3D sensing system in a robotic environment, explored the capabilities of the system to allow the robot to navigate autonomously and interact with a diverse number of everyday objects.

Consortium

The TACO consortium comprised seven European partners (four research institutes, two industrial companies, and one university) located in four different countries: Austria, UK, Germany and Norway. TACO has covered the whole value chain within 3D sensing systems with partners specialising in MEMS hardware cimponents, time-of-flight sensors, 3D image analysis software algorithms and robotic industry applications.

1 **Technikon Forschungs– und Planungsgesellschaft mbH (Austria)**

2 **CTR AG, F&E Zentrum für Sensorik (Austria)**

3 **Stiftelsen SINTEF (Norway)**

4 **TU Wien (Austria)**

5 **Oxford Technologies (UK)**

6 **Shadow Robot Company (UK)**

7 **Fraunhofer-Gesellschaft zur Förderung der angewandten Forschung e.V. (Germany)**

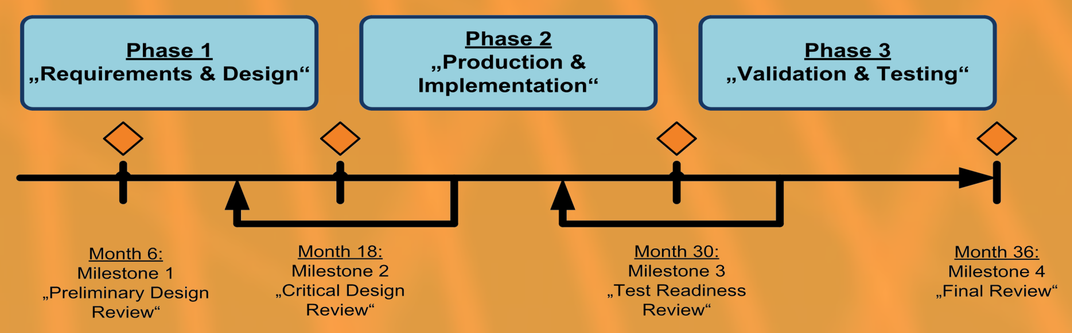
Motivation and Results

The area of robotics is an innovative and growing industry. Currently service robots are adopted to execute works which are dull, dangerous, dirty or dumb. With the further development of service robots, their functionalities are extended and therefore they can fulfil more sophisticated tasks (e.g. in the fields of cleaning, construction, maintenance, security, health care, entertainment and personal assistance). Therefore TACO also focused on producing a 3D sensing system, which included the following three points:

- A novel concept for fast attention level management based on the 3D foveation.
- A 3D laser scanner sensor based on a miniaturised micro-mirror device combined with time-of-flight measurement technology.
- A software framework for fast object recognition in everyday scenes.

The achievement of the TACO scientific and technical objectives was measured against an initial set of verifiable indicators, which were constantly refined and updated in the course of the project in order to reflect the detailed needs and environment of the project.

To achieve its objectives, TACO went through 3 main project phases:



- TACO implemented for the first time an advanced scanning concept, based on an array of steerable micro-mirrors in combination with a pulse laser distance measurement in order to provide 3D imaging, thereby providing accurate data at unsurpassed point rate.
- A 3D sensing system based on minituarised silicon MEMS-based technology can be incorporated into small units mountable as payload on both service robots or on the arm of an industrial robot.
- The new foveation software, in combination with the laser scanner, allows for better object detection and tracking through an optimized trade-off between resolution and frame-rate; detection of regions of interest; and increased sampling density in interesting regions.

Contact

Project Coordinator
Dr. Klaus-Michael Koch
Technikon Forschungs-und Planungsgesellschaft mbH
Burgplatz 3a | 9500 Villach | Austria
Tel: +43 4242 233 55 - 0
Fax: +43 4242 233 55 - 77
Email: coordination@taco-project.eu
Web: www.taco-project.eu

Technical Leader
Mr. Jens T. Thielemann
Stiftelsen SINTEF
PB 124 Blindern | N-0314 Oslo | Norway
Tel: +47 22 06 74 77
Fax: +47 22 06 73 50
E-mail: Jens.T.Thielemann@sintef.no

SEVENTH FRAMEWORK PROGRAMME