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# Omnidirectional sensors for mobile robots

Fraunhofer Institut Intelligente Analyse- und Informationssysteme

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## Introduction

It is a problem to build up suitable omnidirectional sensors for various applications in the field of mobile robots. To develop perception systems which can be offered with reasonable costs is an additional problem.

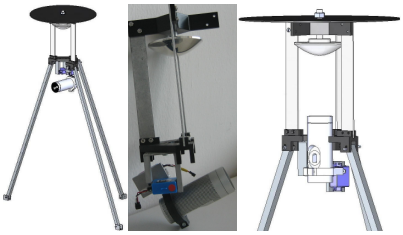
This poster presents the different omnidirectional sensors developed at Fraunhofer Institute for Intelligent Analysis and Information Systems (IAIS) during the past decade [1].

Typical applications are video surveillance [2], teleconferencing, computer vision, Simultaneous Localization And Mapping (SLAM) [3, 4] and virtual reality.

## Omnidirectional vision systems

### Cheap firewire camera

- Apple iSight, firewire camera
- Hyperbolic mirror
- Autofocus
- Pan tilt unit allows either to capture omnidirectional or undistorted images



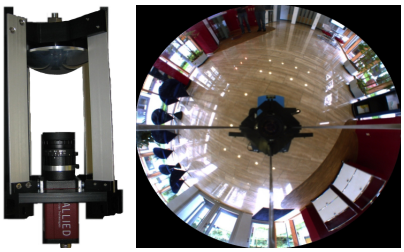
***Pro:***
- Cheap
- Flexible for searching

***Con:***
- Low resolution (VGA)

**Applications:**
- Indoor SLAM
- Identifying door plates
- Teleoperation

### High resolution system

- AVT Marlin F-145-C
- "Fujinon DF6HA-1B" object lens
- Firewire connection
- Hyperbolic mirror



***Pro:***
- High resolution (1392 × 1038 pixels)
- Replaceable object lenses

***Con:***
- Expensive

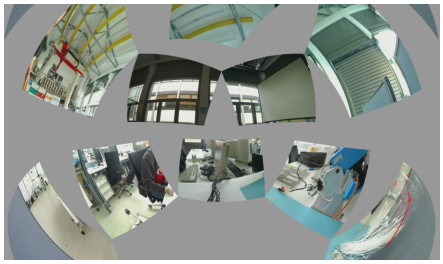
**Applications:**
- Indoor SLAM
- Teleoperation

## Panoramic vision system Spherecam

- Eleven Logitech QuickCam 9000 aiming in different directions
- Penta-dodecahedron shaped chassis
- 220×220×380mm (L×W×H)
- 3fps in total (VGA)
- approx. 22Mio. pixels (at full resolution)
- USB 2.0

***Pro:***
- Reasonable costs
- Undistorted images
- Very high resolution capturing of environment
- Scalability due to eleven dedicated data channels

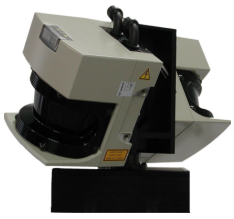
***Con:***
- High amount of data
- Synchronisation



**Applications:**
- Visual SLAM
- Video surveillance

## Continuously rotating 3D laser scanner

- 3D point cloud (omnidirectional distance values)
- Remission values allow to create black/white textured maps
- Approx. 1fps



***Pro:***
- Precise distance information
- Small size of data
- Possible detection of materials

***Con:***
- No color information
- High power consumption

**Applications:**
- 6 DoF SLAM with precise metric maps
- Spatial measurements for cartography

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**References**
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[2] Murphy, R.: Trial by fire [rescue robots]. Robotics & Automation Magazine, IEEE 11 (3) (Sept. 2004) 50–61
[3] Durrant-Whyte, H., Bailey, T.: Simultaneous localization and mapping: part I. In: IEEE Robotics & Automation Magazine. Volume 13. (2006)
[4] Bailey, T., Durrant-Whyte, H.: Simultaneous localization and mapping (SLAM): part II. In: IEEE Robotics & Automation Magazine. Volume 13. (2006)