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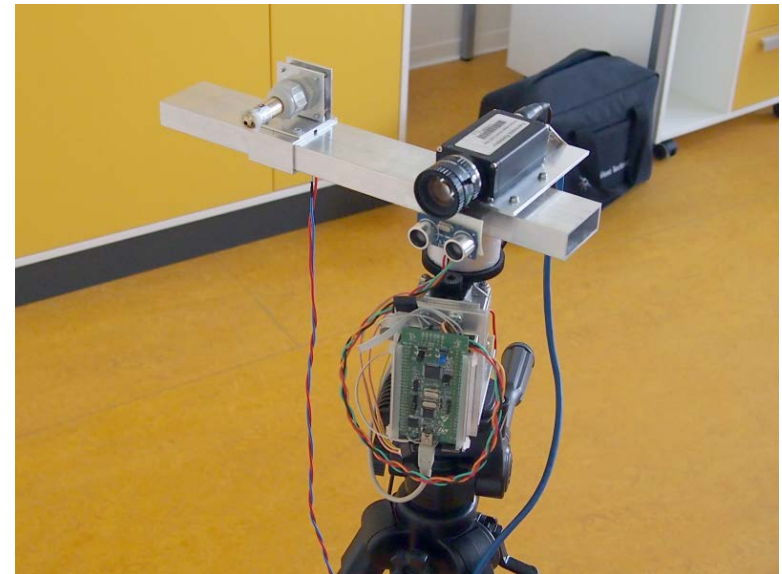
The Mobile Platform for 3D Space Automatic Mapping

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INTRODUCTION

Mobile platform

- Device for autonomous 3D space mapping
- Unknown area exploration (abandoned mines, collapsed buildings, indoor rooms, ...)
- Two rangefinder:
 - Optical rangefinder
 - Ultrasonic rangefinder
- Possibility to mount other sensor
- Using rangefinder fusion



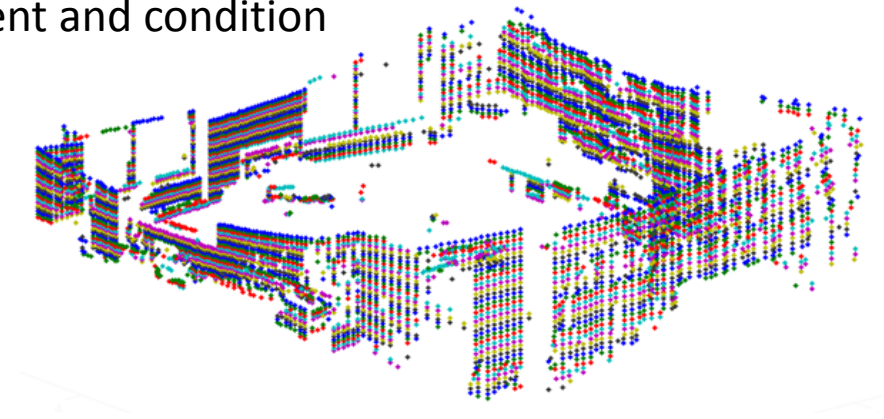
OBJECTIVES

- 3D space mapping
- Mobile platform
- Used rangefinders
- Distance determination
- Vector map creation
- Results



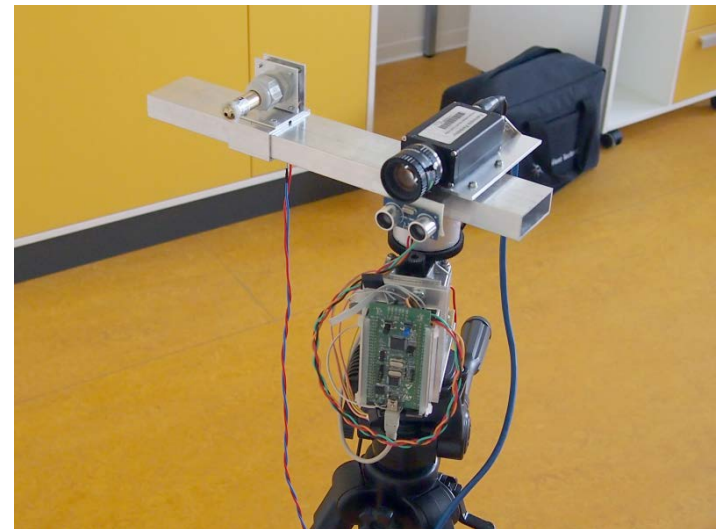
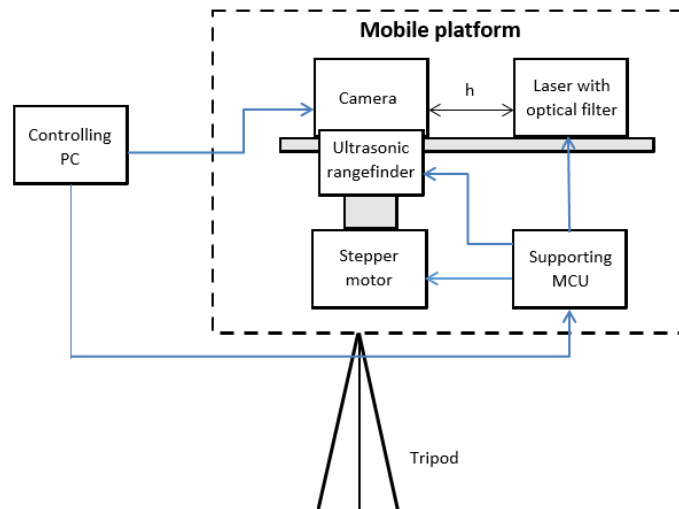
3D SPACE MAPPING

- Mapping process is especially important in unexplored areas with poor accessibility:
 - old unstable buildings
 - abandoned mines
 - caves
 - indoor rooms
- Creating of the vector maps will provide clear information about its extent and condition



MOBILE PLATFORM

- The mobile platform is equipped with a camera and a laser with the changeable distance between a camera and a laser emitter. The 360 degrees rotation of the measuring head is provided by a powerful and fast stepping motor. The connected computer controls the complete system and receives images from a camera.



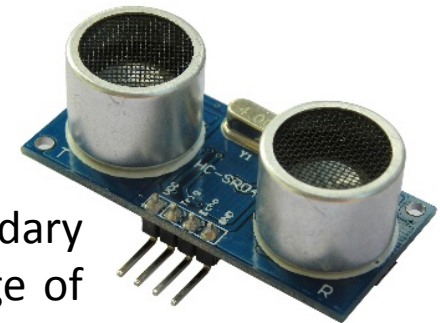
USED RANGEFIDERS

Optical rangefinder:

- Consist from high-quality Basler **camera** and powerful **laser** which is dispersed by an optical filter into the vertical line
- **Camera** features:
 - GiGE interface
 - 1 GB Ethernet
 - 32 FPS
 - resolution about 1300 x 1000 px
- **Laser** features:
 - powerful red laser (200mW)
 - optical filter with an angle 60°

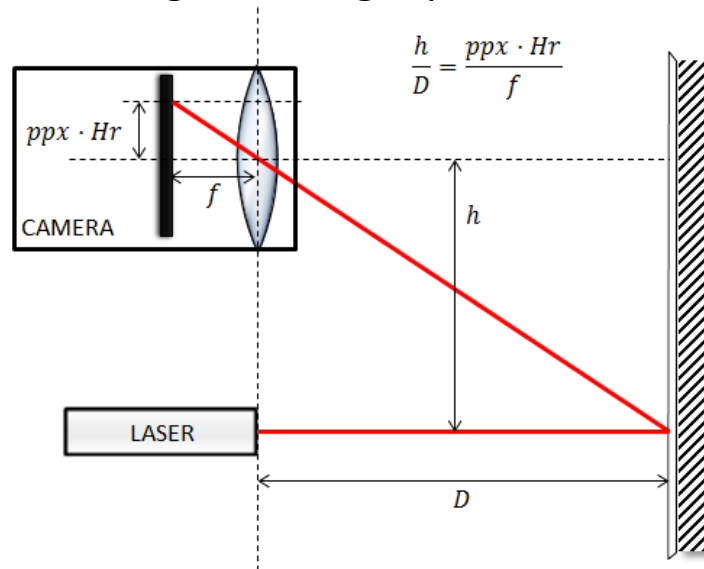
Ultrasonic rangefinder:

- The ultrasonic sensor is used as a secondary rangefinder which improves a measurement range of the mobile platform



OPTICAL RANGEFINDER - PRINCIPLE & ALGORITHM

- For calculation of distance D the triangulation method is used.
- The detection algorithm of the laser line is based on image processing methods and can be decomposed into three sequential steps. The first is *RGB Segmentation*, the next is *Component labelling* and the last is *Distance determination* according following equation.



$$D = \frac{h \cdot f}{Hr \cdot ppx}$$

RESULTS

- Measurement range: 0,01 m – 15 m
- Measurement error: $\sim 10 \text{ m} < 5\%$, $\sim 15 \text{ m} < 10\%$
- Measuring time: 10s - 360° scan, 400 ms for process of one frame).
- The algorithm was verified in variable light conditions.

