EUROPA (FP7-231888)
European Robotic Pedestrian Assistant

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Tasks in Urban Settings

- Personal assistance
- Delivery and transportation tasks
- Guidance

Key Challenges

- Navigation in densely populated urban environments
- Complex and large deployment areas (Zurich downtown)
- Incomplete knowledge
- Challenging perception problems
- Intuitive interface to users
- Relating language and spatial models

System Overview & Key Contributions Achieved so far

World Modeling

- Efficient hierarchical SLAM approach that considers that the underlying space is a manifolds and not a Euclidian space [ICRA'10]
- Relative bundle adjustment for consistent local map estimation using stereo vision [RSS'09]
- Semantic information via supervised learning (road, sidewalk, grass, …) [AURO'09]
- Approach to build a spatial representation from spatial description via linguistics
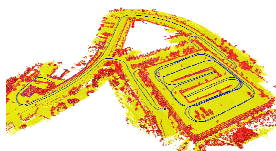
3D map of a parking garage
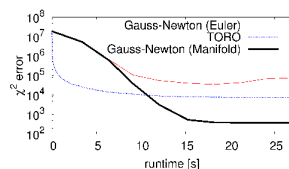
Urban Navigation

- Localization aligning local laser observations with aerial image data [RSS'09]
- Accurate visual odometry under difficult lighting conditions and non-static scenes [BMVC'09]
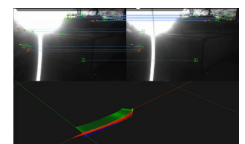- Topological map generation from public map sources (OSM)
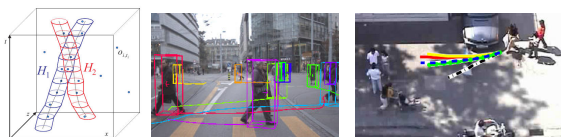

Topology from OSM
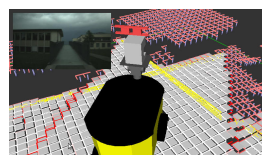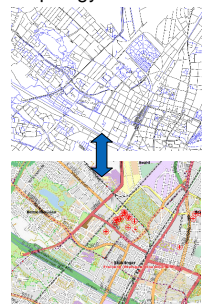
Traversability estimation

Localization via satellite images

Visual odometry under challenging conditions

Dynamic Object Handling

- Vision-based dynamic obstacle detection
- Robust multi-person detection and tracking in busy inner-city scenarios [ICRA'09] considering constraints and space requirements of pedestrians
- Probabilistic short-term motion prediction for dynamic path planning considering obstacles in the scene [ICCV'09]
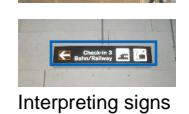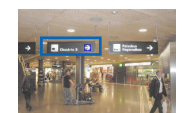

Detection, tracking, and prediction of pedestrians in crowded scenes

User Interface & Interaction

- Access to the robot via mobile devices (iPhone, PDA) and via Internet
- Communication via touch screen, cameras, sound, and text interpretation
- Robot understands spatial descriptions, route instructions, and can answer queries about the environment (e.g., "where is the closest post box between me an the cathedral?")
- Robot can read and follow signs using a learning approach based hierarchical implicit shape models [ICRA'10]

iPhone access

Interpreting signs