



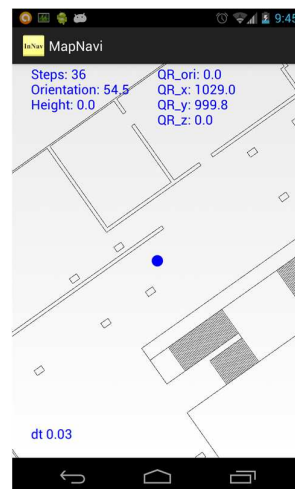
Current developments in the HCU Mobile Mapping System and its use in research and teaching

Friedrich Keller, Sören Leitz, Gordeon Thie, Steffen Kagerah
and Harald Sternberg

Geomatik | Hafencity Universität

HCU | Hafencity Universität
Hamburg

Navigation in buildings



- Where can we get the map data?

Motivation

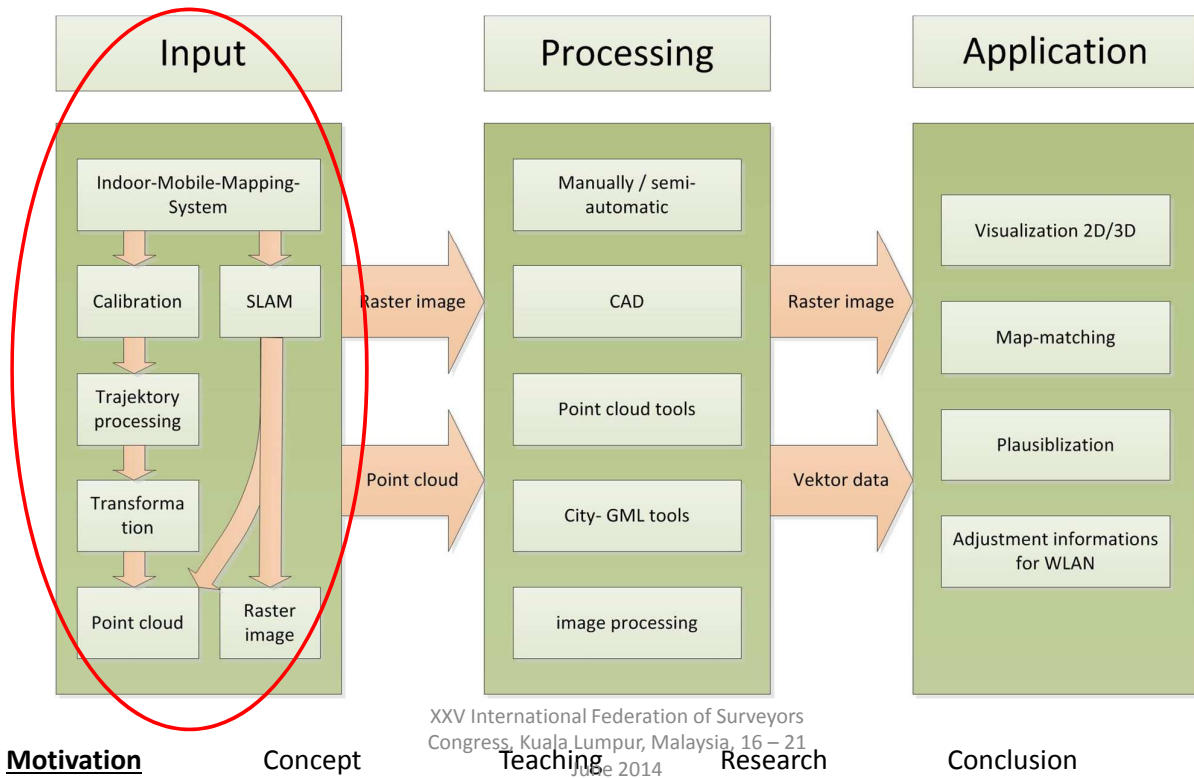
Concept

Teaching

Research

Conclusion

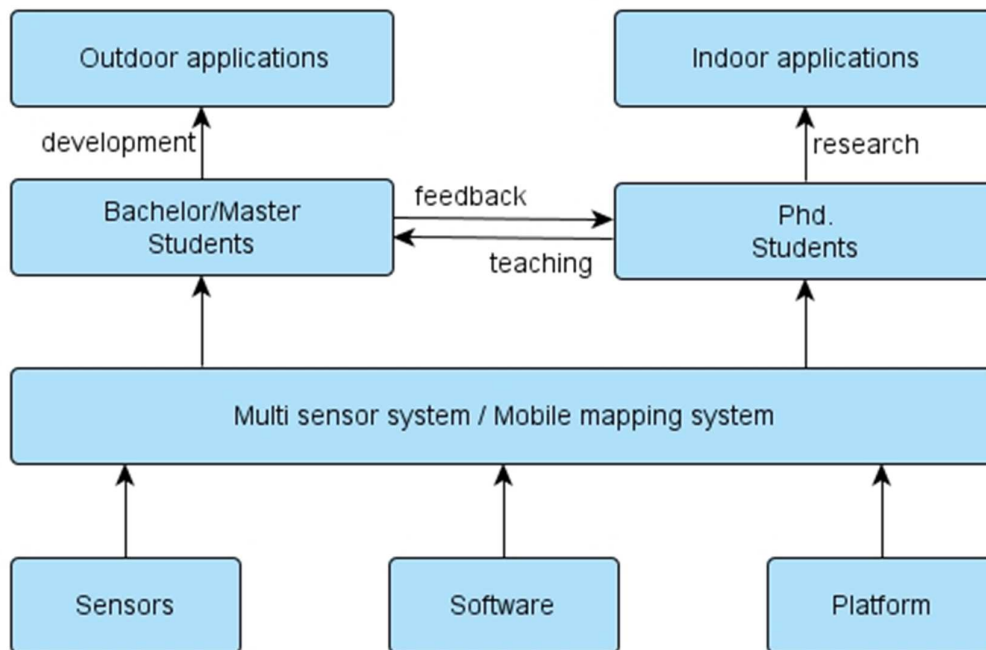
Idea for getting indoor navigation data



Concept for the Multi Sensor System



Concept for research and teaching



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Motivation

Concept

Teaching

Research

Conclusion

Teaching

- Outdoor
 - 1 x MA Configuration of the system
 - 1 x BA Calibration of the system
 - 1 x BA Testing “structure from motion”
- Indoor/Outdoor
 - 1 x MA Calibration of the stereo camera system
- Use in lectures
 - Integrated navigation

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Outdoor configuration for teaching

- „Standard“ Mobile Lidar System (MLS)
- Commercial software for trajectory processing
Novatel Inertial Explorer
- Point cloud processing with solutions from students
- Configuration and calibration as content of teaching



Z+F 5010



Novatel OEMV



IMAR RQH 1003



Odometer

Motivation

Concept

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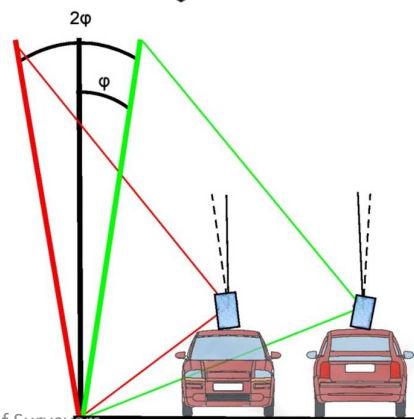
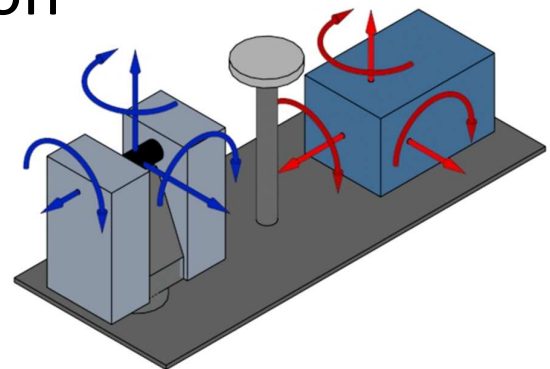
Teaching

Research

Conclusion

Calibration

- Only system calibration
- DOF 7
 - Leverarm (3DOF)
 - Roll
 - Pitch
 - Yaw
 - Time
- Achievable accuracy
lower cm range



Motivation

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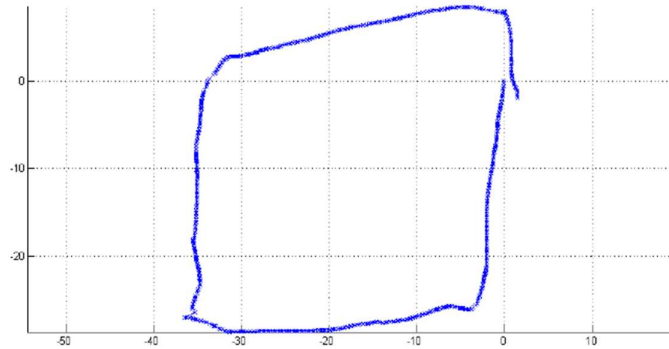
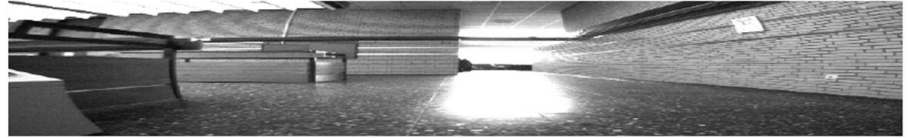
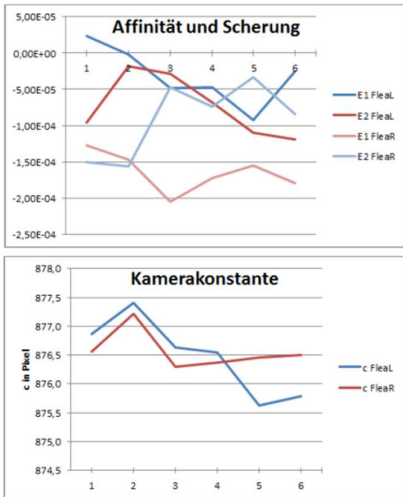
Teaching

Research

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Stereo camera system

- Master thesis about calibration and visual odometry



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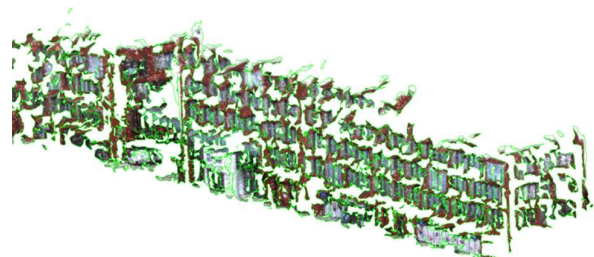
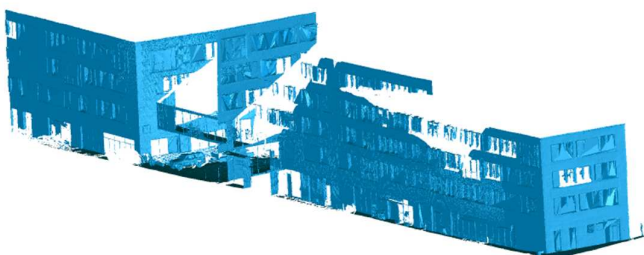
Concept

Teaching

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Conclusion

Structure from motion tests



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Motivation

Concept

Teaching

Research

Conclusion

Indoor configuration for research

- Developed from existing outdoor system
- Replace GPS as position- und time system
 - Position by total station
 - Time by IMU
- Own processing of trajectories required



IMAR RQH 1003



Odometer



Z+F 5010



Leica TPS 1201+



Motivation

Concept

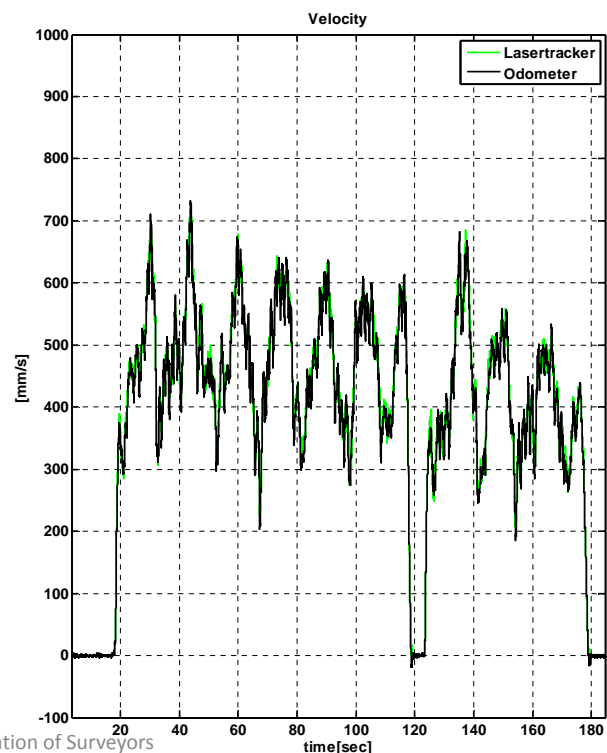
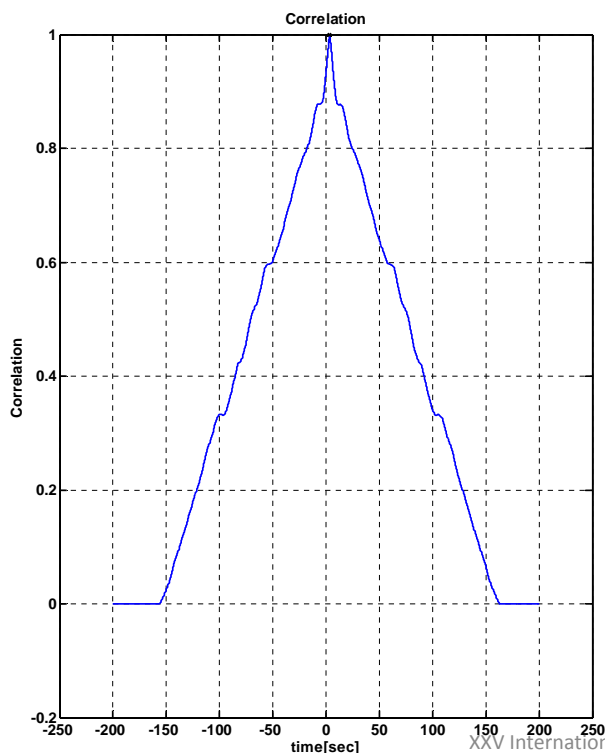
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Indoor setup with total station



Motivation

Concept

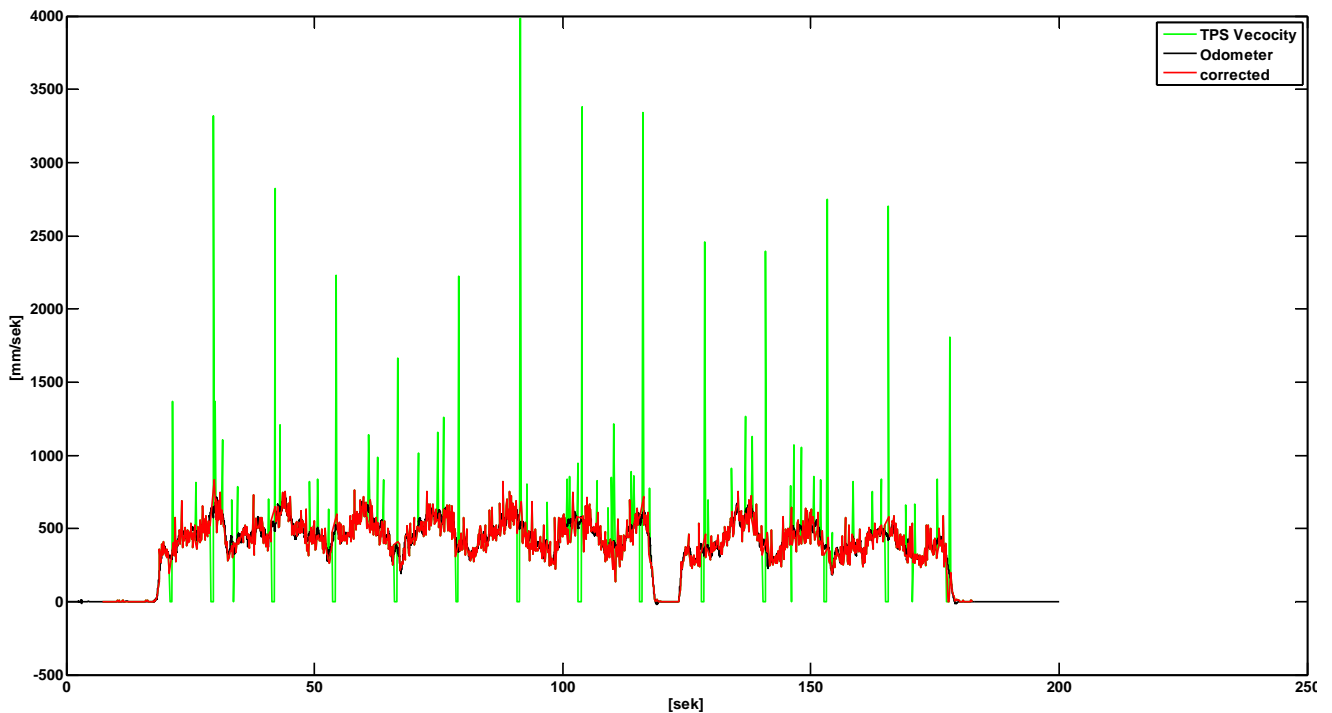
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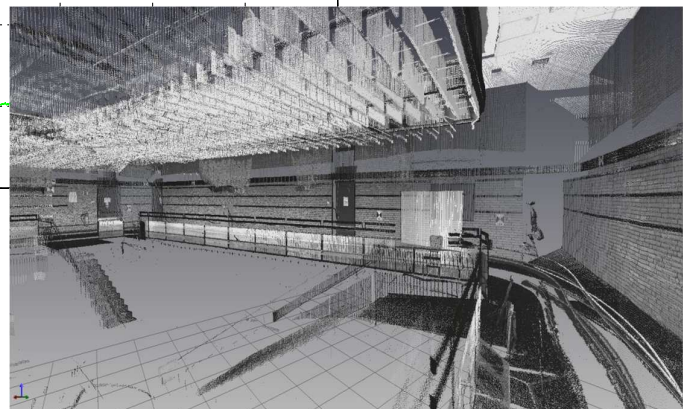
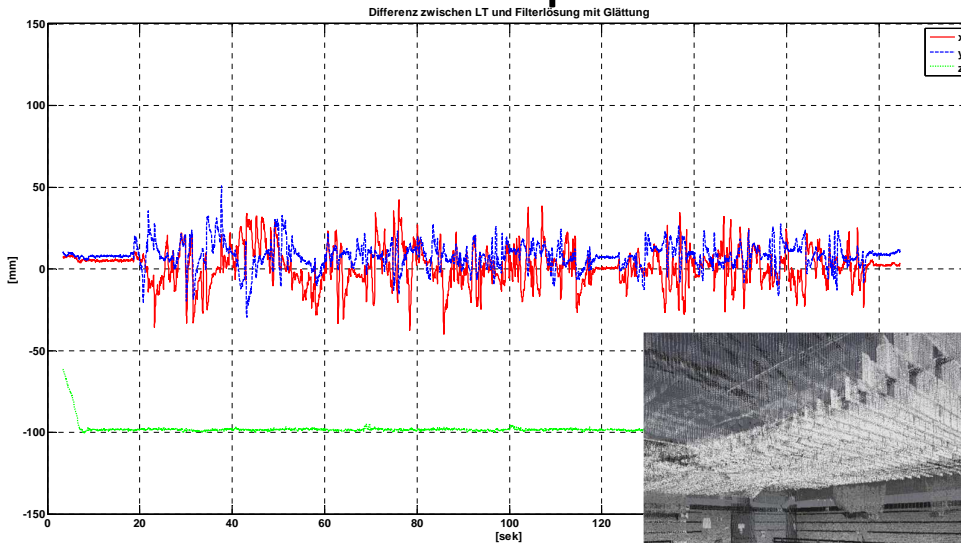
Indoor setup with total station



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Motivation Concept Teaching Research Conclusion

Indoor setup with total station



without total station RMS 35mm
 with total station RMS 14mm

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Motivation Concept Teaching Research Conclusion

Conclusion

- Good experience with this concept
- The students are open to new technologies

- Student's work for this year
 - 1 x MA Total station timing
 - 4 x BA
 - SLAM
 - Calibration low-cost scanner
 - Uncertainty of point clouds
 - Low-cost IMUs

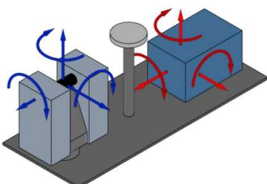
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June 2014 Teaching Research **Conclusion**



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Precise indoor mapping as a basis for coarse indoor navigation
(Journal of Applied Geodesy, October 2013)

Multi-sensor platform for indoor mobile mapping system calibration and using a total station for indoor applications
(Remote Sensing, 2013; 5(11):5805-5824)



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