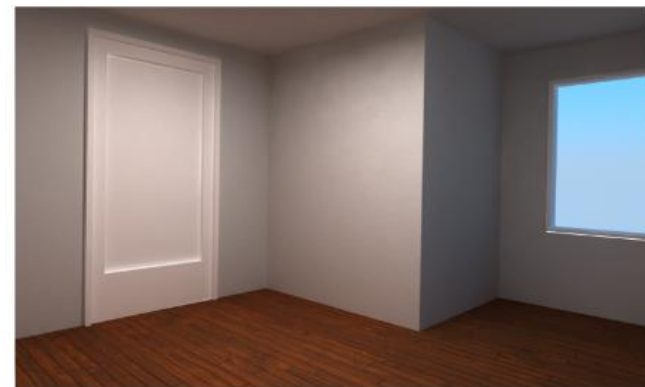
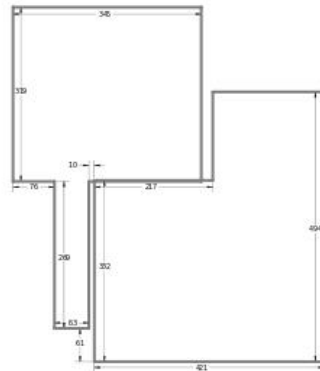
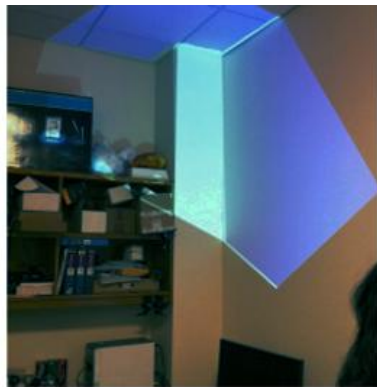


Interactive Acquisition of Residential Floor Plans



Young Min Kim, Jennifer Dolson, Mike Sokolsky,
Vladlen Koltun, Sebastian Thrun

Stanford University

Residential Floor Plans

- Lucky: Blue print
- Ordinary person: Measuring tape & sketch
- Expert: Point to point laser device & sketch
- Interactive hand-held system
 - Microsoft Kinect
 - Projector
 - Input button



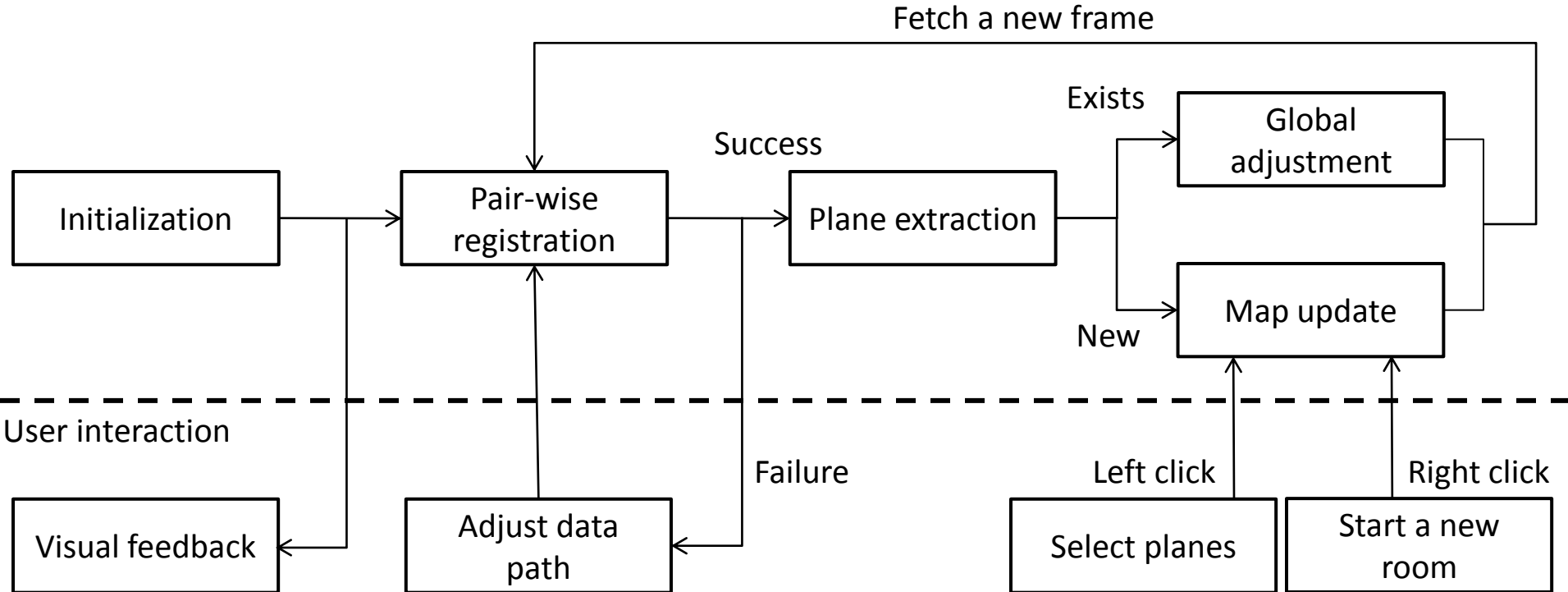
Interactivity



[Mistry et al 2009]

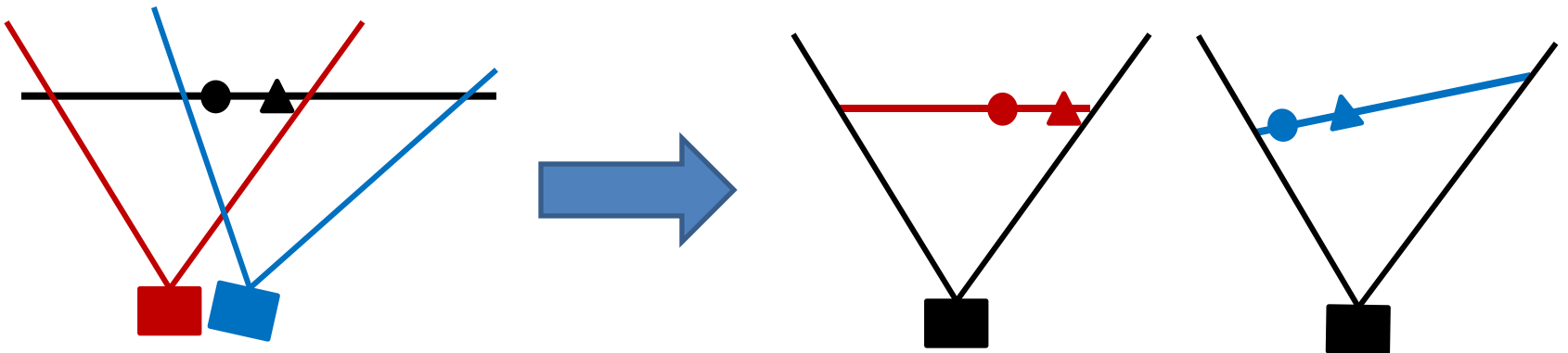


Algorithm



Pair-wise registration

- Transformation between two consecutive frames



Pair-wise registration

- Transformation between two consecutive frames

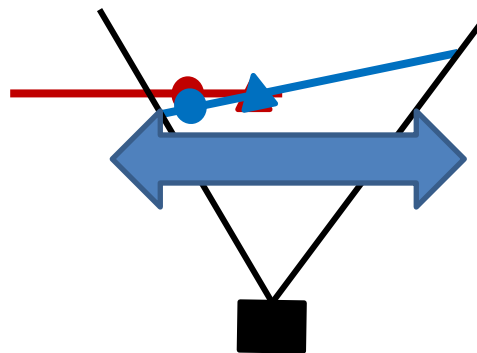
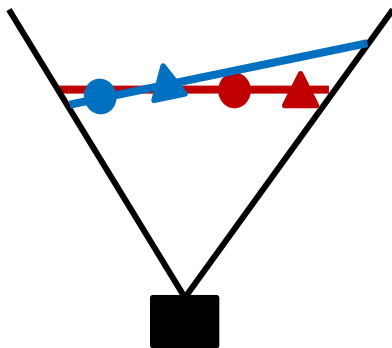
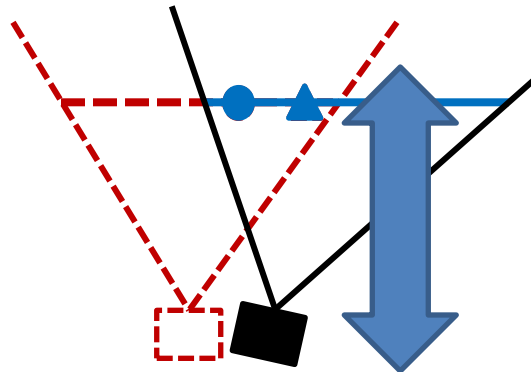
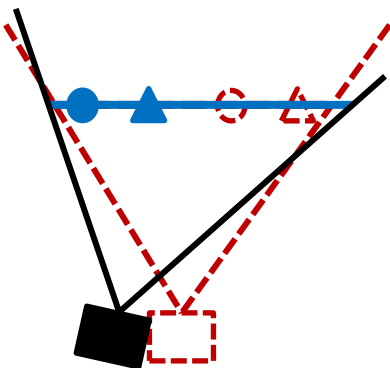


Image features recover displacement parallel to the image plane



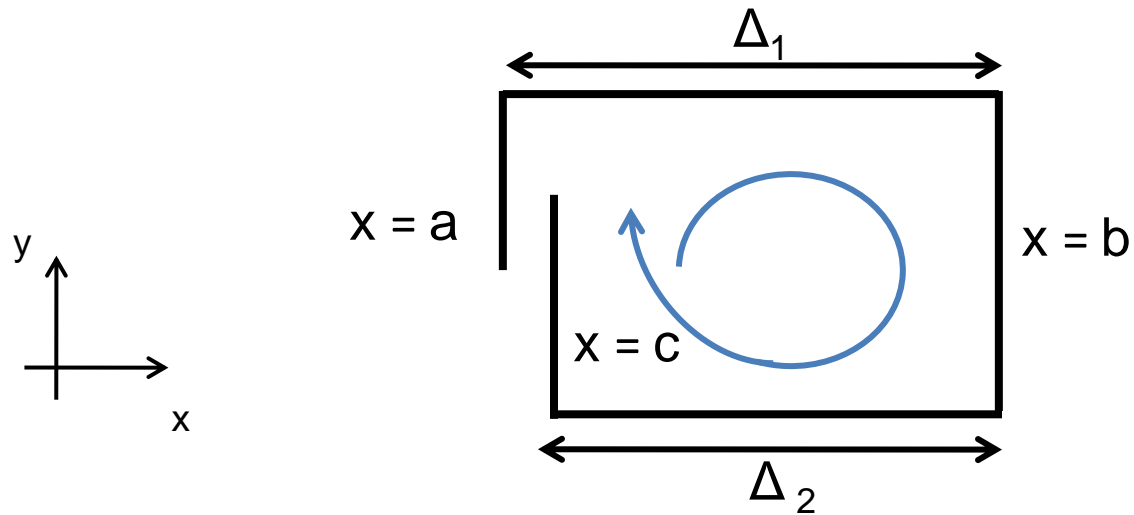
Depth measurements recover displacement along the ray direction

Registration failure

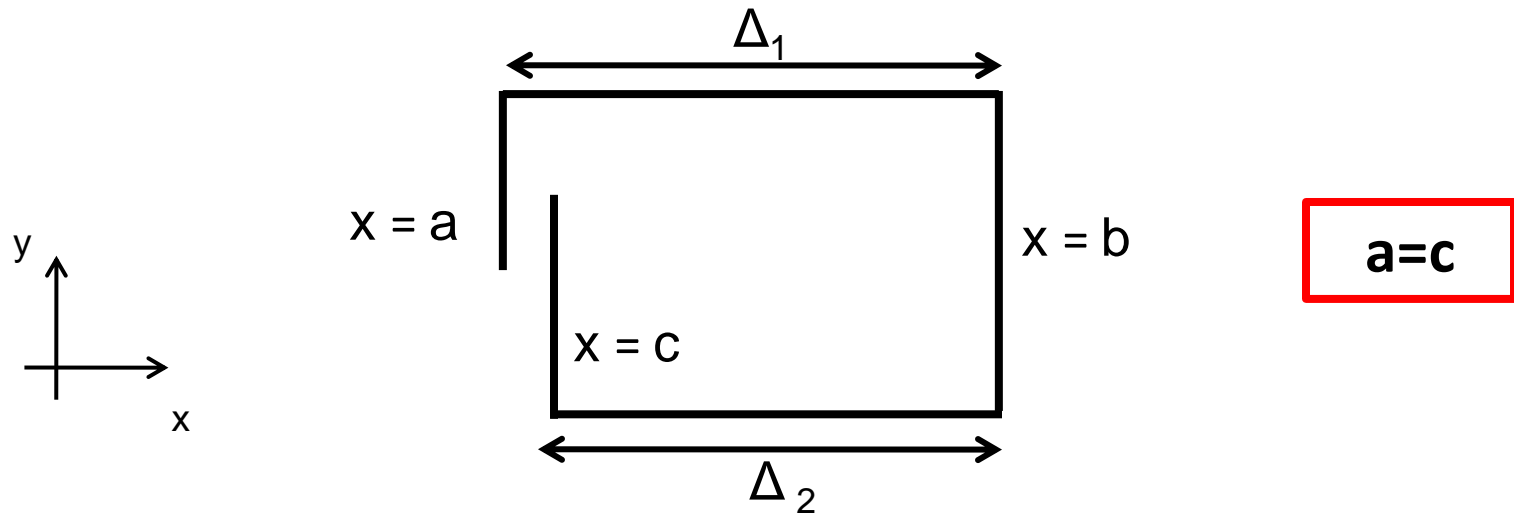




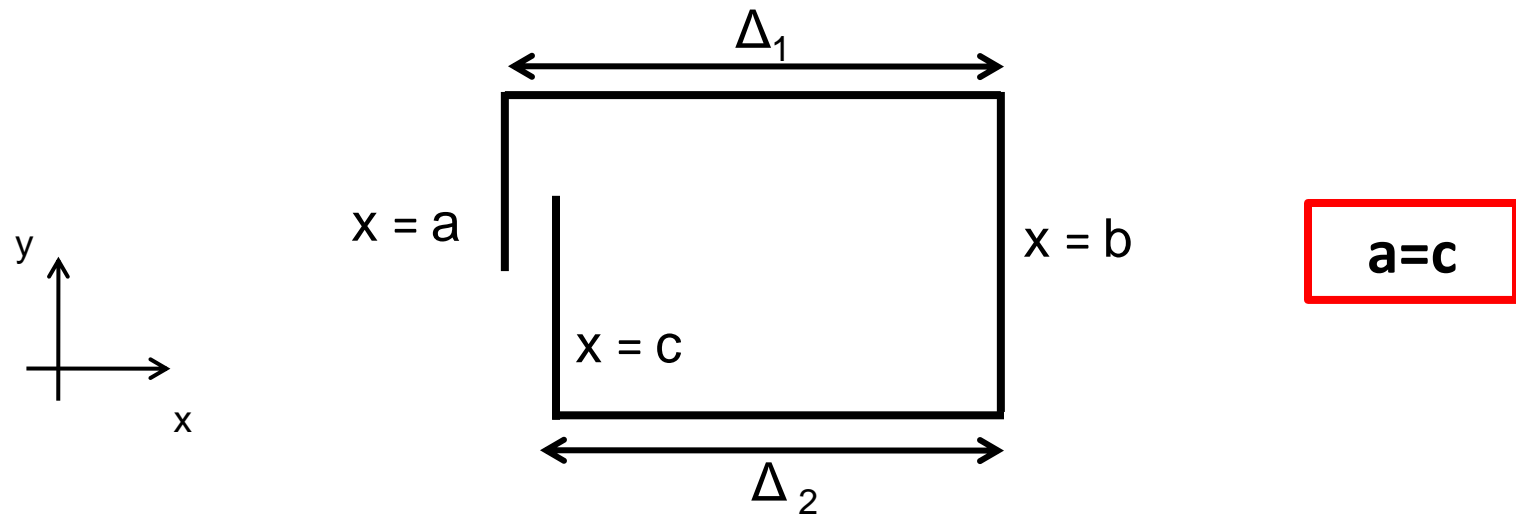
Global Adjustment



Global Adjustment



Global Adjustment



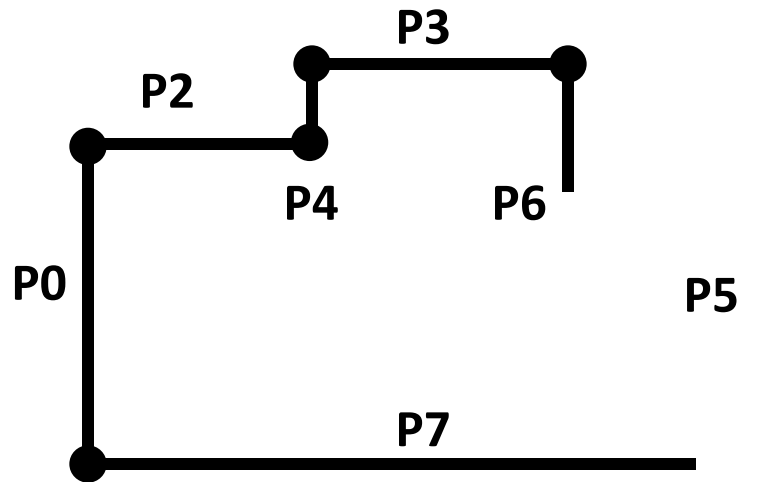
$$\min_{\mathcal{S}^x} \sum_i \left(\frac{\|\Delta_i - m_i\|^2}{\sigma_i^2} \right) \quad \text{s. t. } c_{j1} = c_{j2}, \quad \forall (c_{j1}, c_{j2}) \in \mathcal{C}^x$$

Selecting components

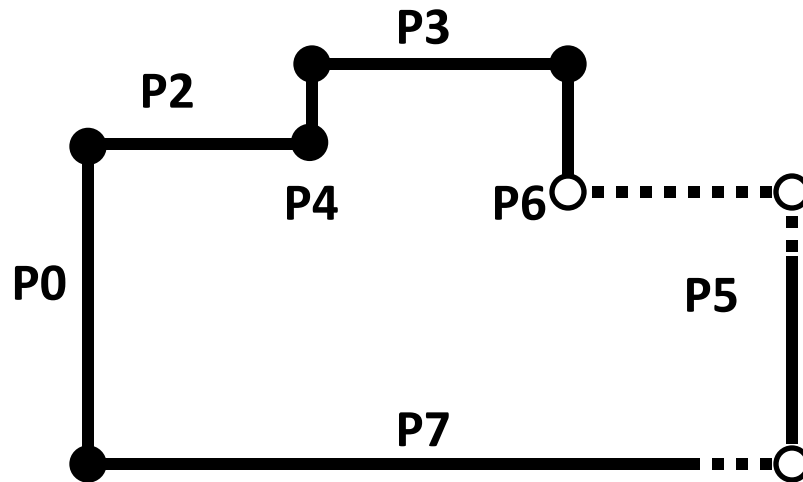


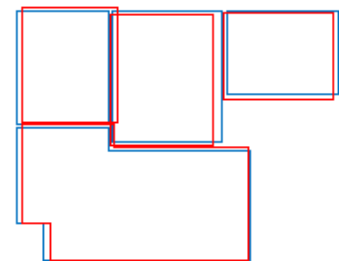
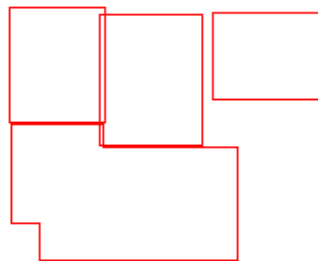
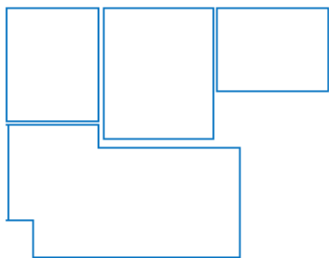
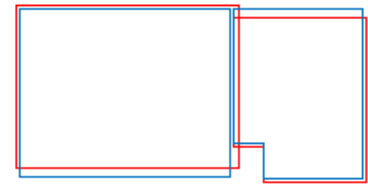
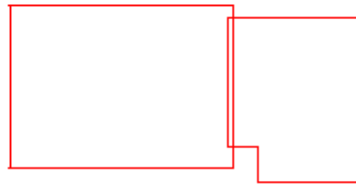
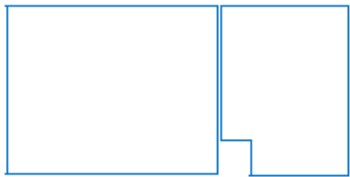
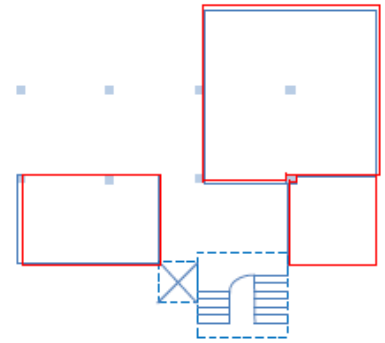
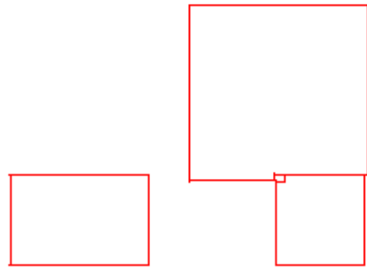
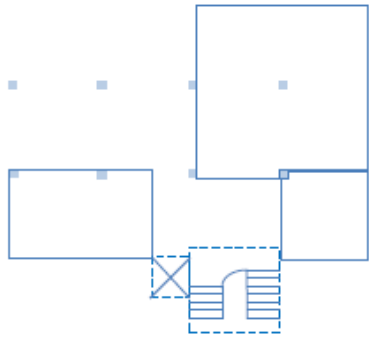
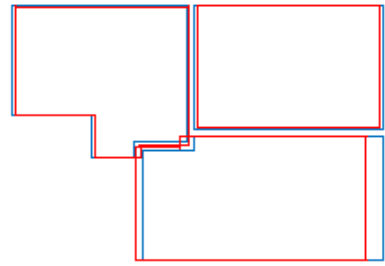
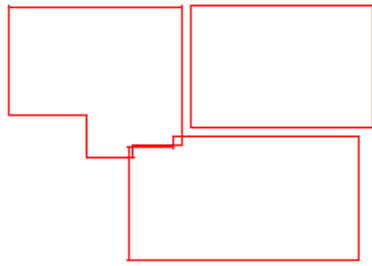
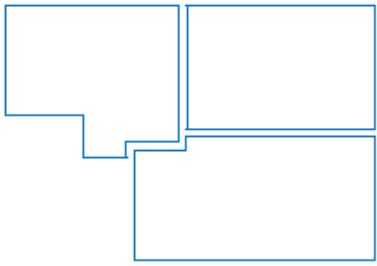


Floor plan generation



Floor plan generation



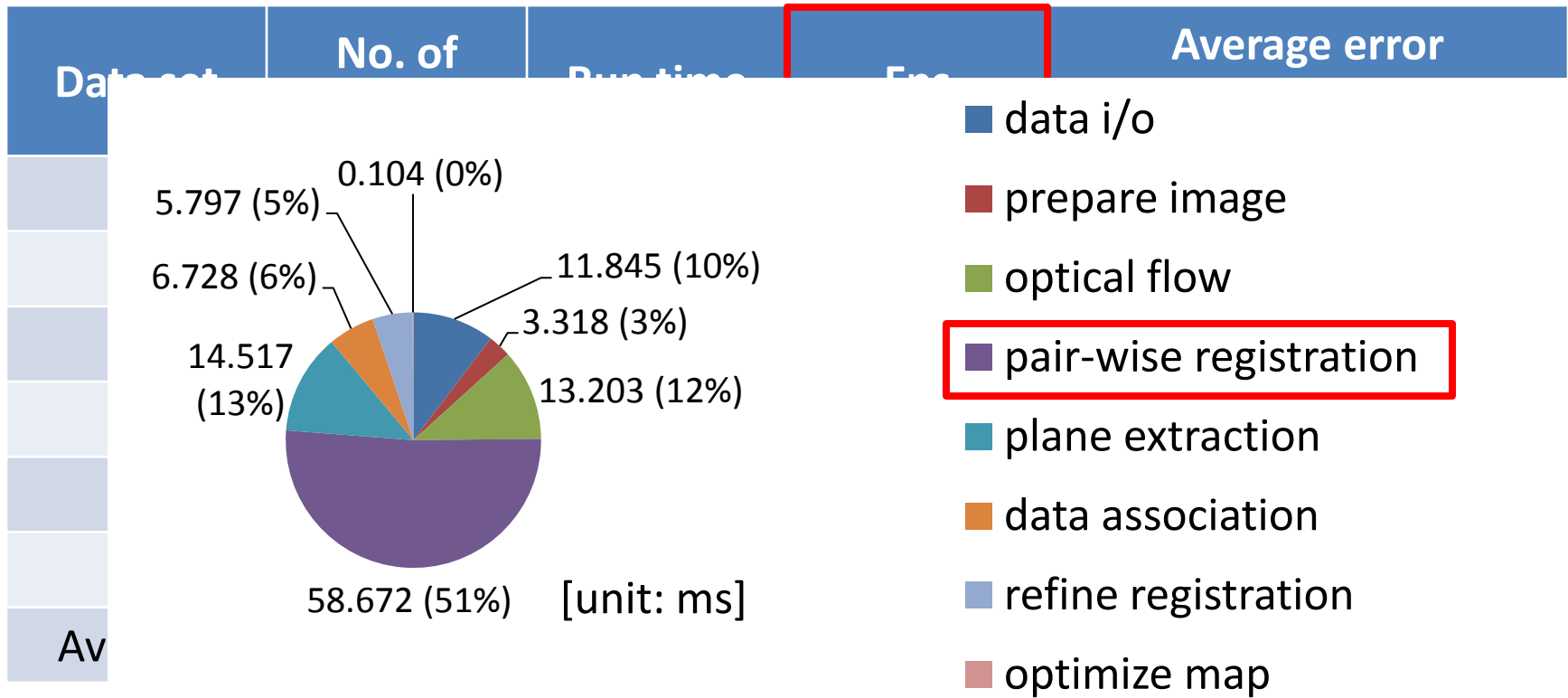


Result

Data set	No. of frames	Run time	Fps	Average error	
				m	%
1	1465	2m 56s	8.32	0.115	4.14
2	1009	1m 57s	8.66	0.064	1.90
3	2830	5m 19s	8.88	0.053	2.40
4	1129	2m 39s	7.08	0.088	2.34
5	1533	3m 52s	6.59	0.178	3.52
6	2811	7m 4s	6.65	0.096	3.10
Average	1795	3m 57s	7.54	0.075	2.86

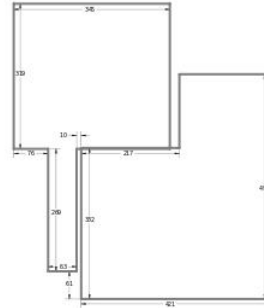
2-5 minutes to initiate, run, and generate floor plan
(10-20 minutes for laser measurements)

Result



7.5 fps on an Intel 2.50GHz Dual Core laptop

Conclusion



- We present a practical system to acquire residential **floor plans** and allow augmented reality.
- The **hand-held** system is composed of a commodity **depth sensor** (Microsoft Kinect) and a **projector**.
- During the process, the projector displays the status of reconstruction on the physical surface scanned.
- From the projection, the user can intuitively sense errors and provide high-level correction if necessary.

Thank you