

SLAM-based Lidar for Generating Indoor GIS

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The global leader in 'go-anywhere' mapping technology.

SLAM-based Lidar for Generating Indoor GIS Data

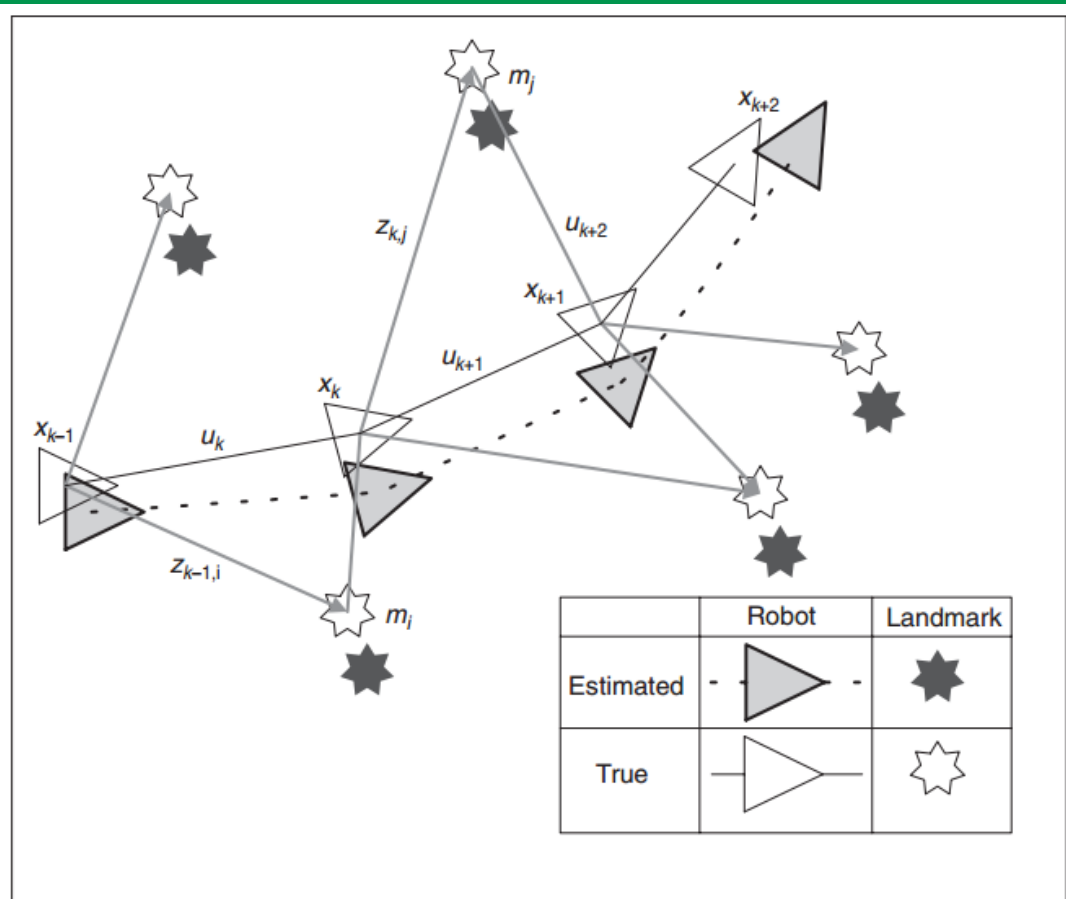


Figure 1. The essential SLAM problem. A simultaneous estimate of both robot and landmark locations is required. The true locations are never known or measured directly. Observations are made between true robot and landmark locations.

Derivation : Markov Localization

- d = data
- o = observation
- a = action
- t = time
- s = state

$$Bel(s_t) = p(s_t | o_t, a_{t-1}, o_{t-1}, \mathbf{K}, o_0)$$

$$\stackrel{\text{Bayes}}{=} \eta p(o_t | s_t, a_{t-1}, o_{t-1}, \mathbf{K}, o_0) p(s_t | a_{t-1}, o_{t-1}, \mathbf{K}, o_0)$$

$$\stackrel{\text{Markov}}{=} \eta p(o_t | s_t) p(s_t | a_{t-1}, o_{t-1}, \mathbf{K}, o_0)$$

$$\stackrel{\text{Total Probability}}{=} \eta p(o_t | s_t) \int p(s_t | s_{t-1}, a_{t-1}, \mathbf{K}, o_0) p(s_{t-1} | a_{t-1}, \mathbf{K}, o_0) ds_{t-1}$$

$$\stackrel{\text{Markov}}{=} \eta p(o_t | s_t) \int p(s_t | s_{t-1}, a_{t-1}) p(s_{t-1} | o_{t-1}, a_{t-2}, \mathbf{K}, o_0) ds_{t-1}$$

$$= \eta p(o_t | s_t) \int p(s_t | s_{t-1}, a_{t-1}) p(s_{t-1} | d_{\mathbf{K}(t-1)}) ds_{t-1}$$

$$Bel(s_t) = \eta p(o_t | s_t) \int p(s_t | s_{t-1}, a_{t-1}) Bel(s_{t-1}) ds_{t-1}$$

The desired posterior is calculated using recursive formula

[Kalman 60, Rabiner 85]

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- Simultaneous Localization And Mapping: **S.L.A.M.**
- No need for GPS (doesn't work indoors anyway)
- Scan while moving through 3D environment versus remaining "static"
- Scan registration "on-the-fly" rather than stitched together later
- Works best in obstructed/occluded environments, uses "clutter" to navigate
- We use the "Map" part of SLAM for input to GIS or CAD

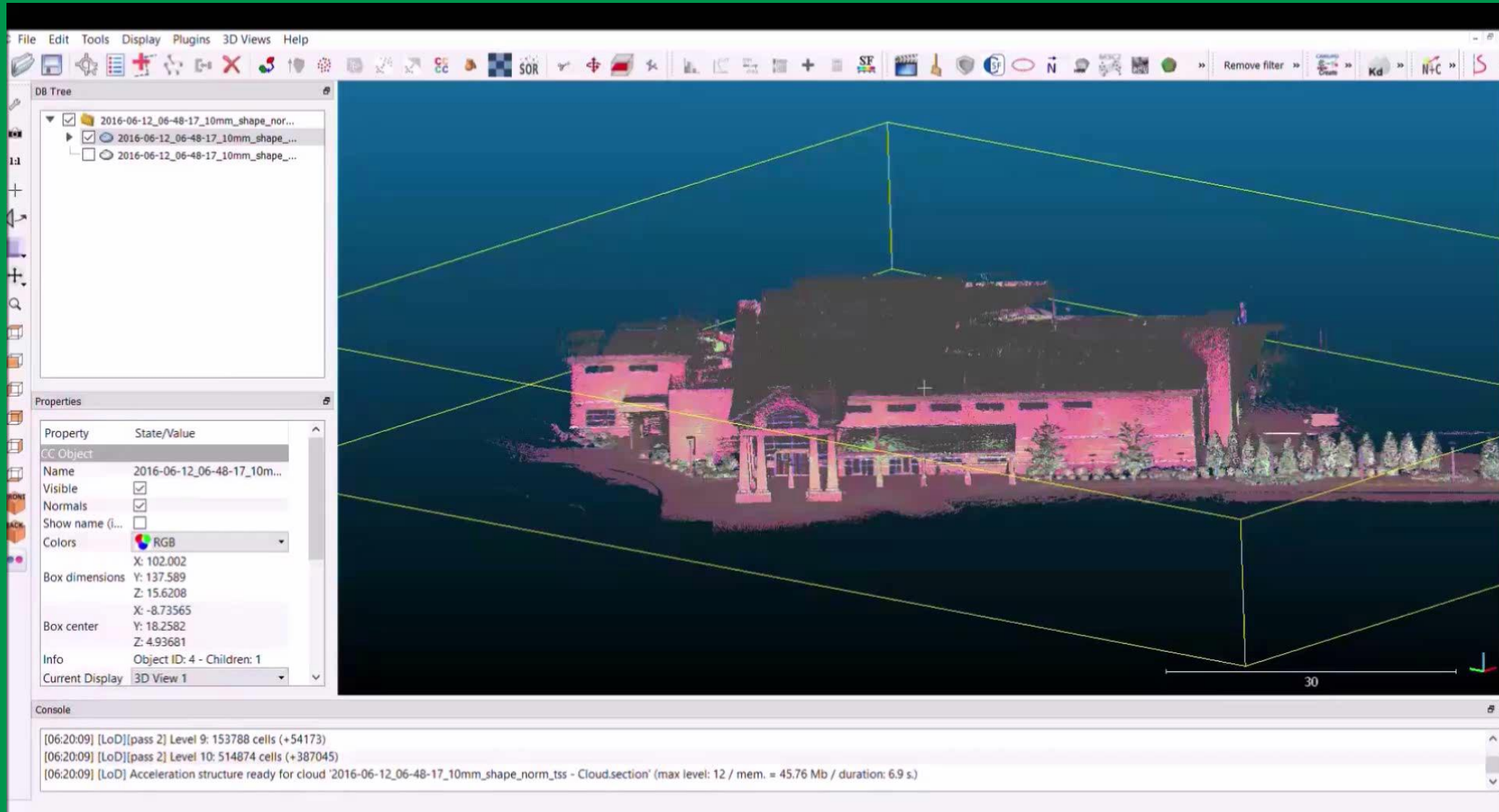
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- Finding a faster way to collect 3D data of interior environments
- Standard Lidar data formats; so fits into existing workflows such as CAD & GIS
- Convergence of CAD/BIM/GIS – GIS makes a lot of sense as it provides the “where” of the data. Just another layer.
- SLAM Lidar applied to indoor mapping analogous to using sub-meter GPS for GIS mapping

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Facilities & Indoors GIS - A Mapping Platform for Your Portfolio


Facilities & Indoors GIS

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Bringing geography to the facility management process gives you context for analyzing



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Thank You!

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3D mobile mapping technology

