SLAM-based Lidar for Generating Indoor GIS

Bill Gutelius / Qntfi

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The global leader in ‘go-anywhere’ mapping technology.

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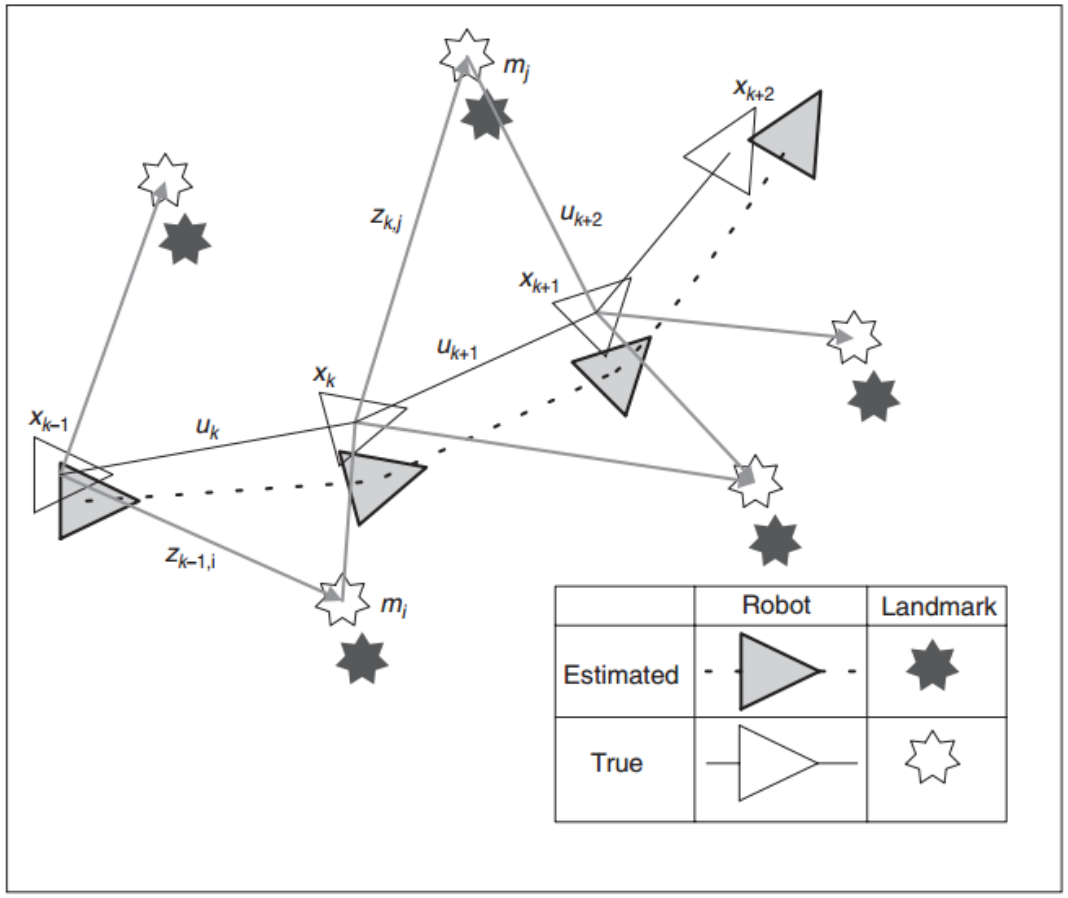

Figure 1. *The essential SLAM problem. A simultaneous estimate of both robot and landmark locations is required. The true locations are never known or measured directly. Observations are made between true robot and landmark locations.*

Derivation : Markov Localization

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

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

Bayes
$$= \eta\, p(o_t \mid s_t, a_{t-1}, o_{t-1}, \mathrm{K}, o_0)\, p(s_t \mid a_{t-1}, o_{t-1}, \mathrm{K}, o_0)$$

Markov
$$= \eta\, p(o_t \mid s_t)\, p(s_t \mid a_{t-1}, o_{t-1}, \mathrm{K}, o_0)$$

Total Probability
$$= \eta\, p(o_t \mid s_t) \int p(s_t \mid s_{t-1}, a_{t-1}, \mathrm{K}, o_0)\, p(s_{t-1} \mid a_{t-1}, \mathrm{K}, o_0)\, ds_{t-1}$$

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

$$= \eta\, p(o_t \mid s_t) \int p(s_t \mid s_{t-1}, a_{t-1})\, p(s_{t-1} \mid d_{0 \mathrm{K} t-1})\, ds_{t-1}$$

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

[Kalman 60, Rabiner 85]

The desired posterior is calculated using recursive formula

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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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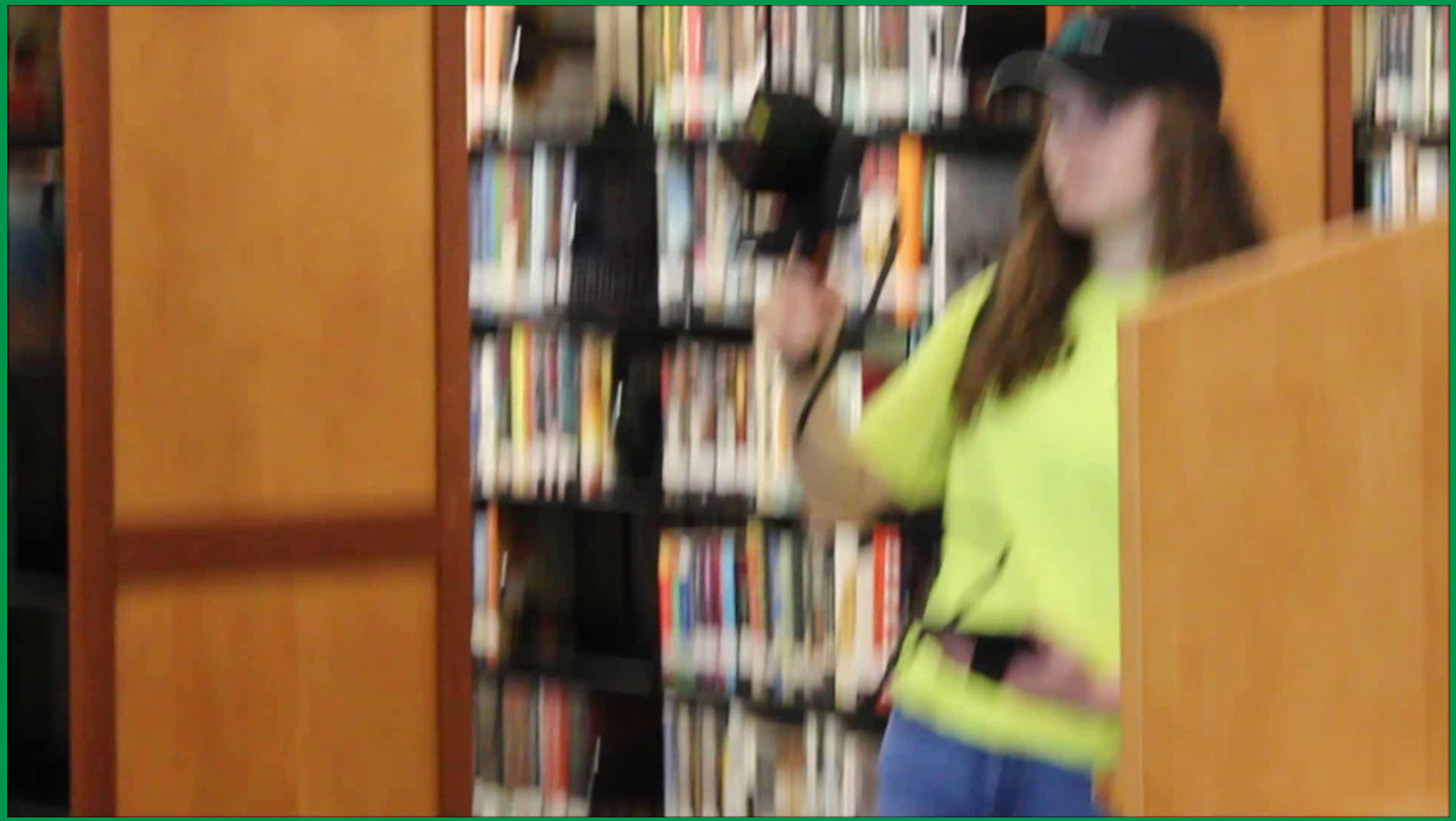

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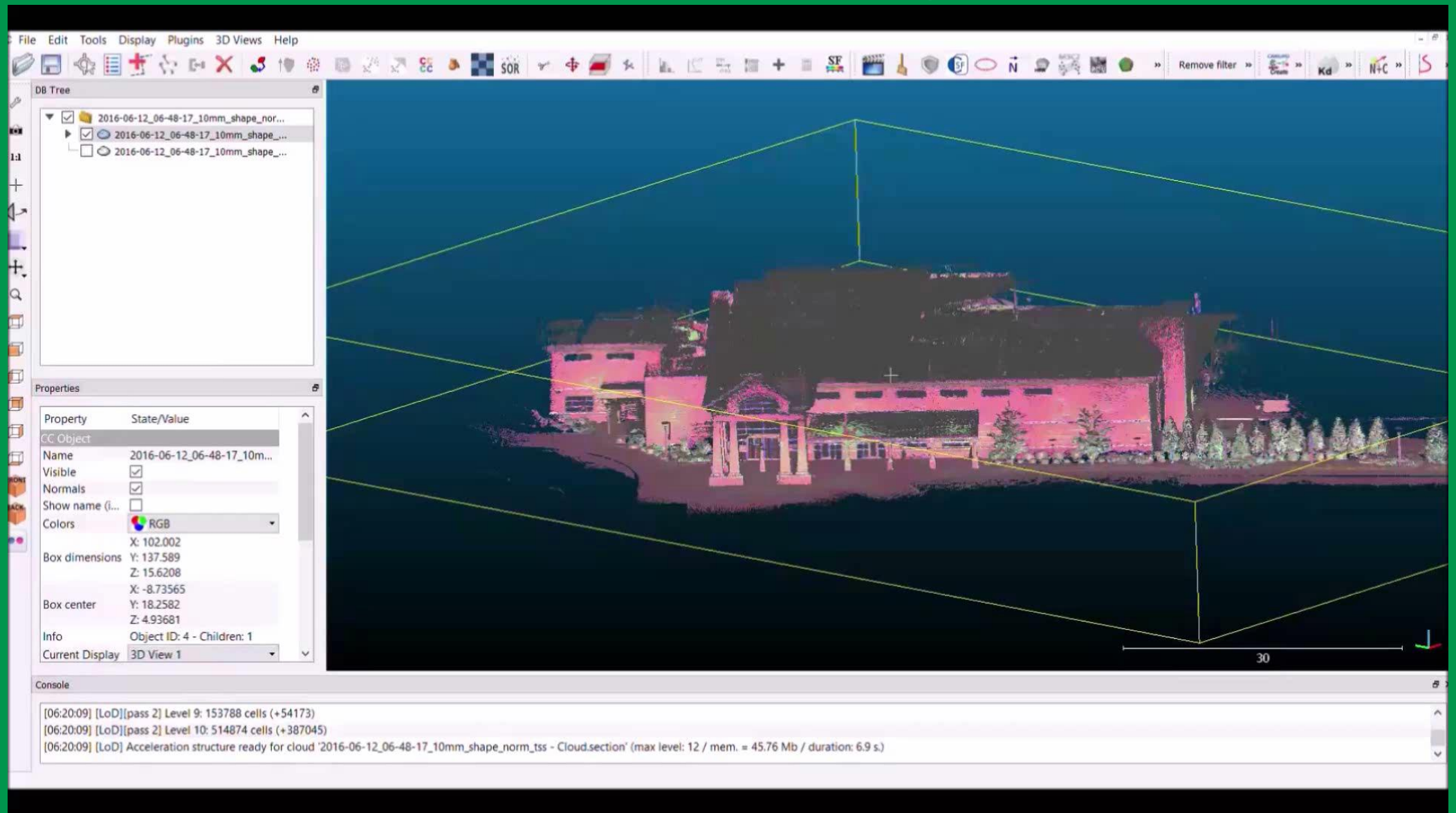

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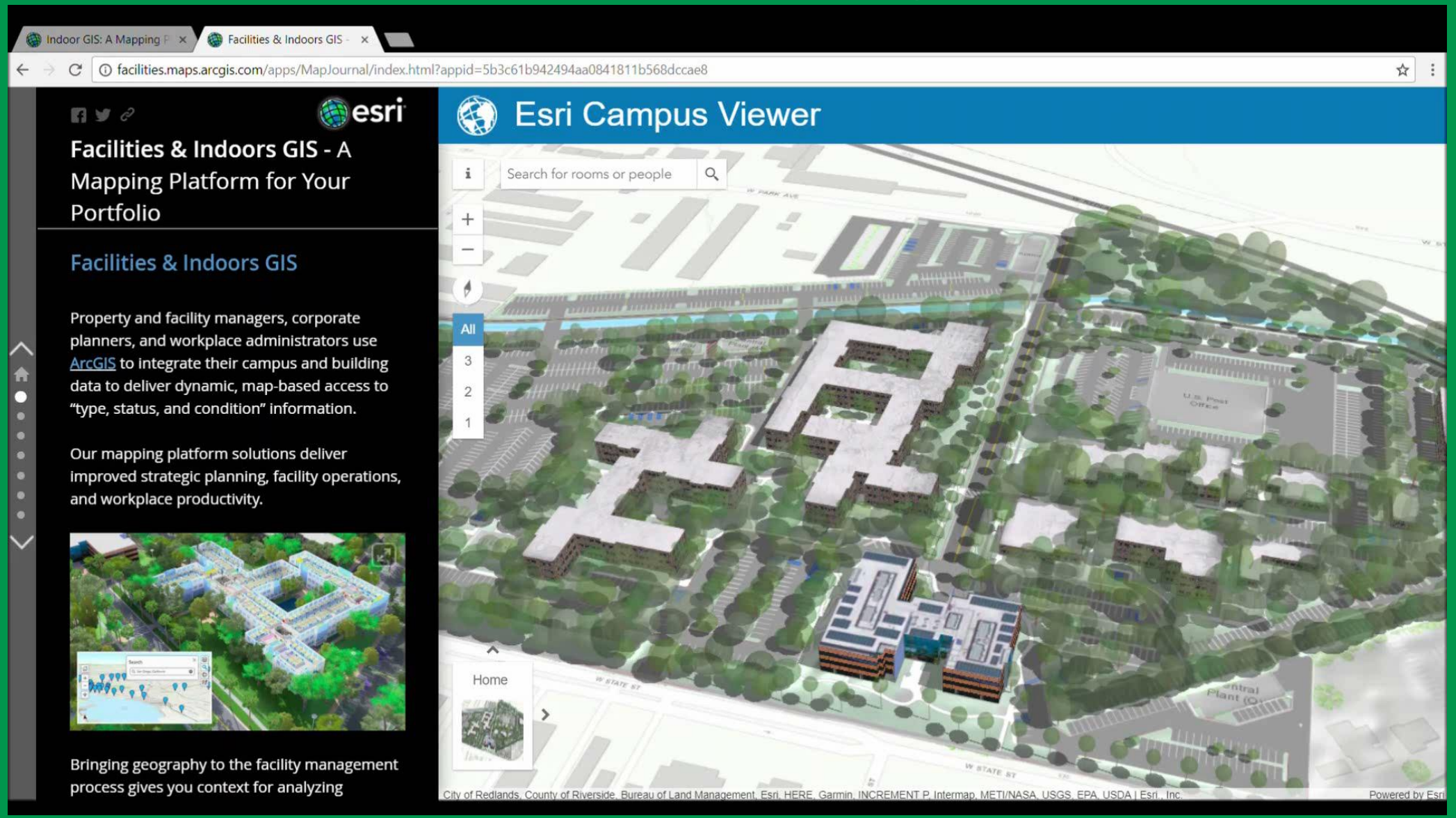

ThankYou!

The experts in "go-anywhere"
3D mobile mapping technology