Self-Positioning Technique for Virtual 3D City Model Construction with the Use of Horizontal Line Laser Scanning

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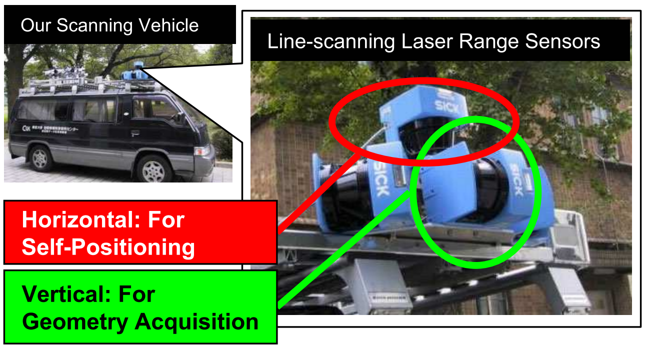
We propose an efficient way to get correct 3D geometric model of urban scene through a novel notion of Spatio-temporal range image. We mount vertical and horizontal line-scanning laser range finders on our vehicle. The vertical one is for acquiring the scene geometry itself, and the horizontal one is for acquiring self-position of the vehicle. Laminating horizontal-scanning data along time axis, we can follow temporal continuity of cross section of the scene geometry. Analyzing this range image, we can estimate the velocity or the self-position of the vehicle without using any external devices as GPS or INS. With this information, we can align the position of the vertical scanning lines.

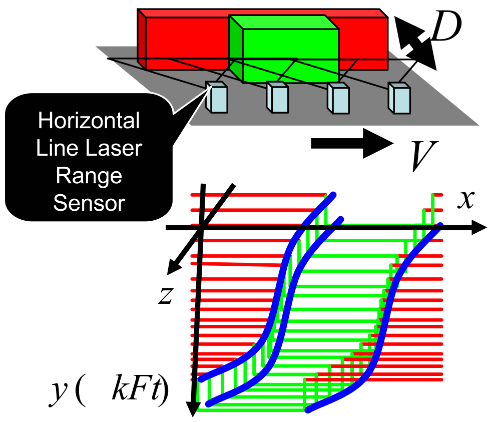
Publication

1. Shintaro Ono, Hiroshi Kawasaki, Kiyotaka Hirahara, Masataka Kagesawa, Katsushi Ikeuchi: "Ego-Motion Estimation for Efficient City Modeling by Using Epipolar Plane Range Image Analysis" Proc. 10th World Congress on Intelligent Transport Systems and Services (Nov. 2003, Madrid, Spain)

Spatio-Temporal Range Image (STRI)

- **EPI: Horizontal line image + temporal axis [Bolles '87]**
- **STRI: <u>Horizontal line *range* image + temporal axis</u>**



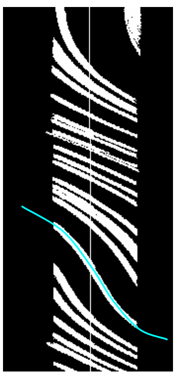


Vehicle Motion Estimation

- Fit polynomial curve to each segment

EPRI

(front view)

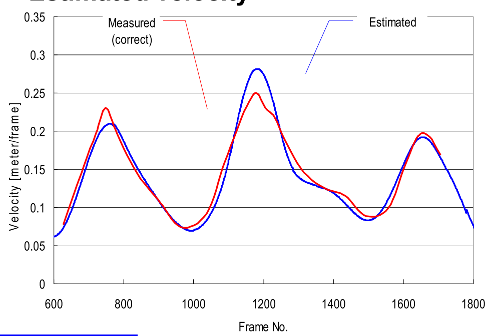


➡ Apply to vertical scanning data

Experimental Result

Actual scene

Estimated velocity



Vertical scanning data