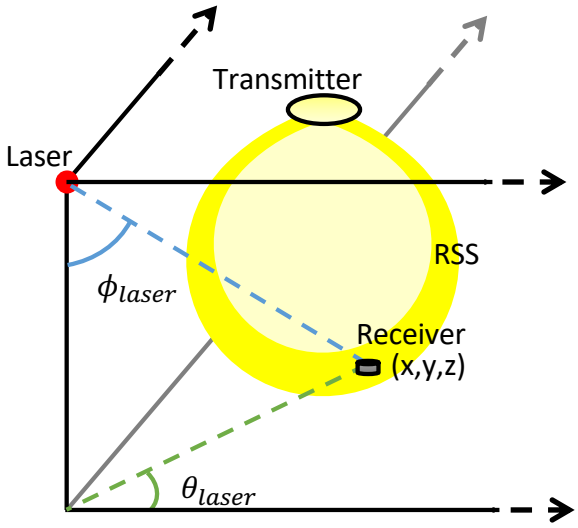
Ray-Surface Positioning Systems and Methods (BU2018-002)

Boston University | Boston, Massachusetts

Overview

Proposed is an indoor Visible Light Positioning system that augments light emissions from conventional luminaires with a steerable laser. By knowing the exact angles between the laser and the receiver being positioned (via free space optical communication) as well as received-signal-strength (RSS) from one or more luminaire sources, we can predict the positon of the receiver in 3-dimensions.

By using angles we show a significant reduction in error all the way to zero (width of the laser) in 2-dimensions. This technique can operate using a single luminaire, making it more versatile than other RSS-based approaches for establishing receiver position especially in 3D.

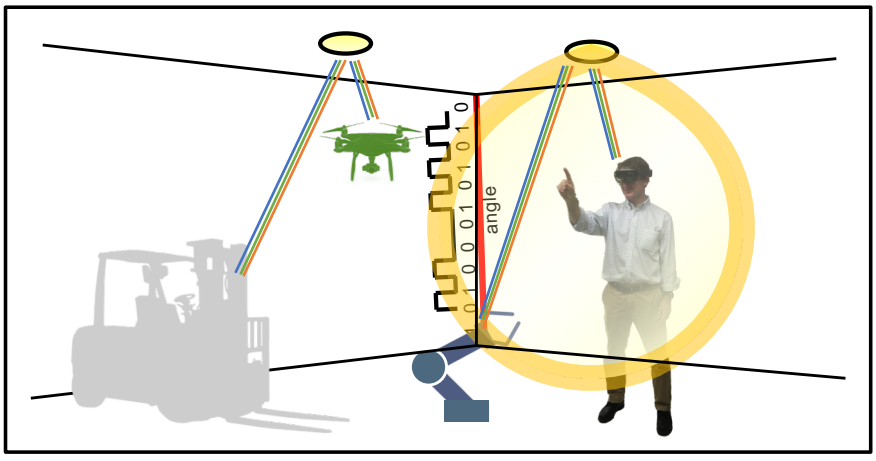


Program Stage

- TRL Level 5 – Prototype Validated in Simulated or Realspace Environment

Applications

- Indoor GPS for security tracking tools, devices, boxes, IoT devices, assets, indoor UAV's, drone to drone positioning
- Consumer data collection
- Indoor navigation in malls, airports, hospitals, hotels or other indoor spaces
- Motion tracking in AR/VR headsets and robotics



Differentiation

- Resolves height uncertainty (3D) in Indoor Visible Light Positioning (VLP) using a steerable laser
- Accuracy is to cm or less
- Infrastructure-based solution like GPS (cost and energy savings)
- Active Communication
- Privacy-preservation (option to opt in or opt out)
- Piggyback lighting infrastructure and coverage
- Services multiple targets including mobile devices
- Outperforms all existing solutions

Intellectual Property

- BU IP# 2018-002, US Patent https://patents.google.com/patent/US10527712B2/

Keywords: Visible Light Positioning (VLP), Light-based Positioning, Indoor Positioning, Infrastructure-based, Luminaire, LED lighting, Lambertian, Location Based Services (LBS)

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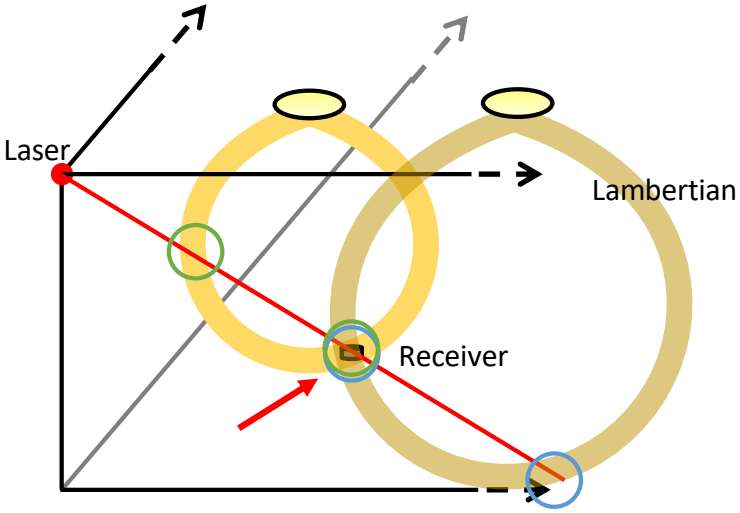
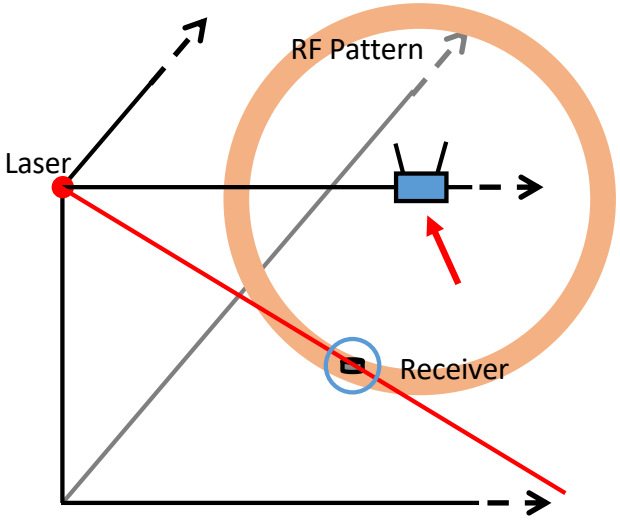
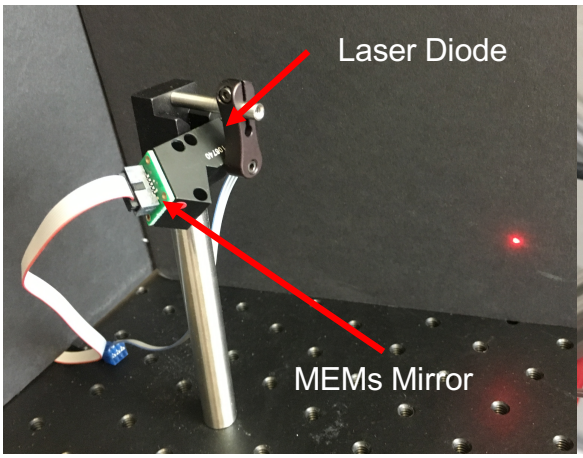
Using Multiple Luminaires and Other Surfaces (E.g., RF Antenna)

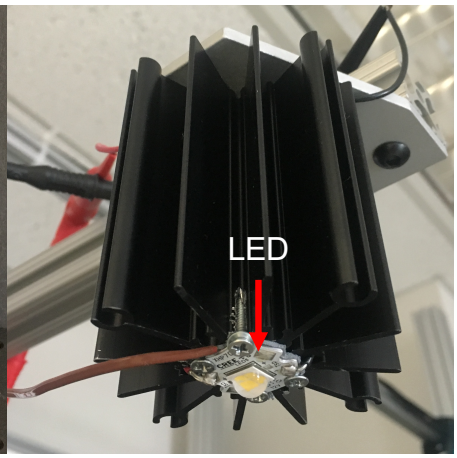




Example Components

- Ray (steerable laser)
  - MEMs Mirror
  - Mirrocle Scan Module
  - 40° Field of View
  - 1kHz scan rate
  - Eye safe 5mW laser
- Surface (Lambertian)
  - CREE XLAMP LED





Related Publications

- 2019 International Symposium on Wireless Communications Systems (ISWCS19) SS10 - Visible Light Communications for the Industry 4.0, "*Visible Light Positioning for Location-Based Services in Industry 4.0", E.W. Lam, T.D.C. Little,* https://doi.org/10.1109/ISWCS.2019.8877305
- 2019 Second Global LiFi Congress, *"Indoor 3D Localization with Low-Cost LiFi Components"*, E.W. Lam, T.D.C. Little, https://doi.org/10.1109/GLC.2019.8864119
- 2018 IEEE International Conference on Communications Workshops (ICC Workshops), 1900030, "*Resolving Height Uncertainty in Indoor Visible Light Positioning Using a Steerable Laser*", E.W. Lam, T.D.C. Little, https://doi.org/10.1109/ICC.2019.8761558

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