LED Based Indoor Navigation

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LED Based Indoor Navigation

**Applications:**

- Automated vehicles for office functions
- Patient tracking in hospitals
- Indoor navigation for the visually impaired people
- Emergency guidance systems for people in the building
- Automated tour guides
- Profiling customers’ habits or shopping assistance
Indoor Navigation Methods (1/2)

- Global Positioning Systems (GPS) cannot provide location information indoors or in many urban areas
- Localization indoors with cell phone signals is too inaccurate

**Method 1: Golding & Lesh**

Aided Dead-reckoning:
- fluorescence (60 Hz Intensity)
- temperature
- magnetic field (strength, dir.)
- ...

using a Bayesian probabilistic update method
Indoor Navigation Methods (2/2)

Method 2: Hahnel, Burgard, Fox, Fishkin, Philipose

Bayesian Reasoning:
- topological map of the building
- RFID tags as landmarks

We know:
- The position of RFID tags
- Markov model that describes the likelihood of detecting an RFID tag given its location relative to the antennas.
**Pros and Cons**

- The fluorescent lighting in Method 1 and RFID tags in Method 2 can be replaced by LED’s.

<table>
<thead>
<tr>
<th></th>
<th><strong>Fluorescence</strong></th>
<th><strong>RFID tag</strong></th>
<th><strong>LED</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>No code</td>
<td>Coded ID</td>
<td>Coded ID</td>
<td></td>
</tr>
<tr>
<td>Active</td>
<td>Passive</td>
<td>Active</td>
<td></td>
</tr>
<tr>
<td>Local</td>
<td>Local</td>
<td>Local</td>
<td></td>
</tr>
<tr>
<td>Not directional</td>
<td>Not directional</td>
<td>Directional</td>
<td></td>
</tr>
<tr>
<td>Multipurpose</td>
<td>Single purpose</td>
<td>Multipurpose</td>
<td>Velocity</td>
</tr>
</tbody>
</table>
Physical Questions

- What is the effective range of LED’s?

- What is the effective angle and width of the LED light beam? Can individual beams (or group beams) be detected?

- What is the switch rate, code rate and data rate for LED’s?

- What is Interference from other LED lamps and natural light?
  - Coding, frequency selectivity

- How can we deal with the areas that LED light cannot cover?

- ... ...
THANKS!