
Project: IEEE P802.15 Working Group for Wireless Personal Area Networks (WPANs)

Submission Title: [VLC use case with image sensors]

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Abstract: [Advantage of image sensor for optical signal and position detector is explained. The example of high-speed image sensor also are presented.]

Purpose: [Contribution to IEEE 802.15 SG-VLC]

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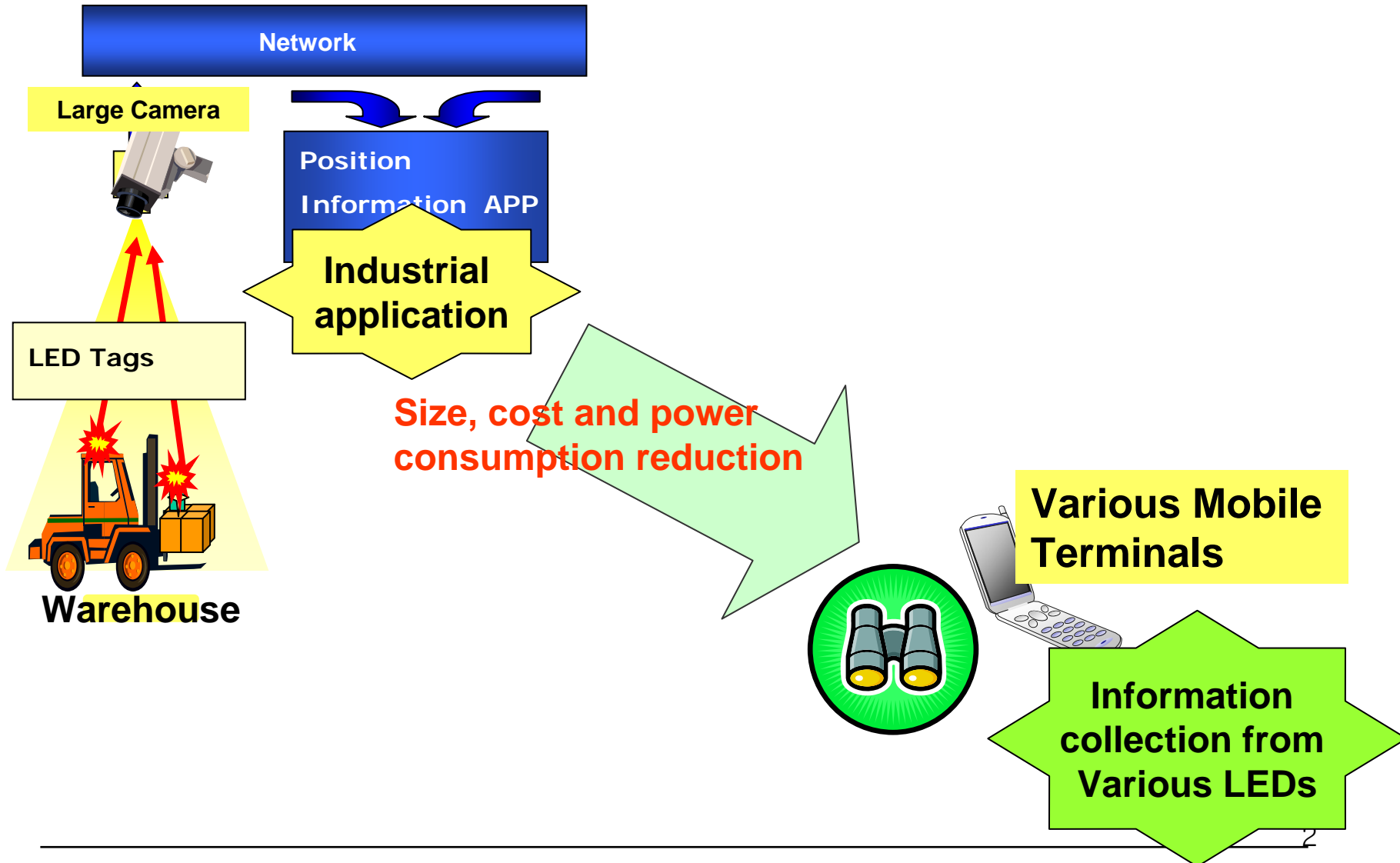
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VLC use case with image sensors

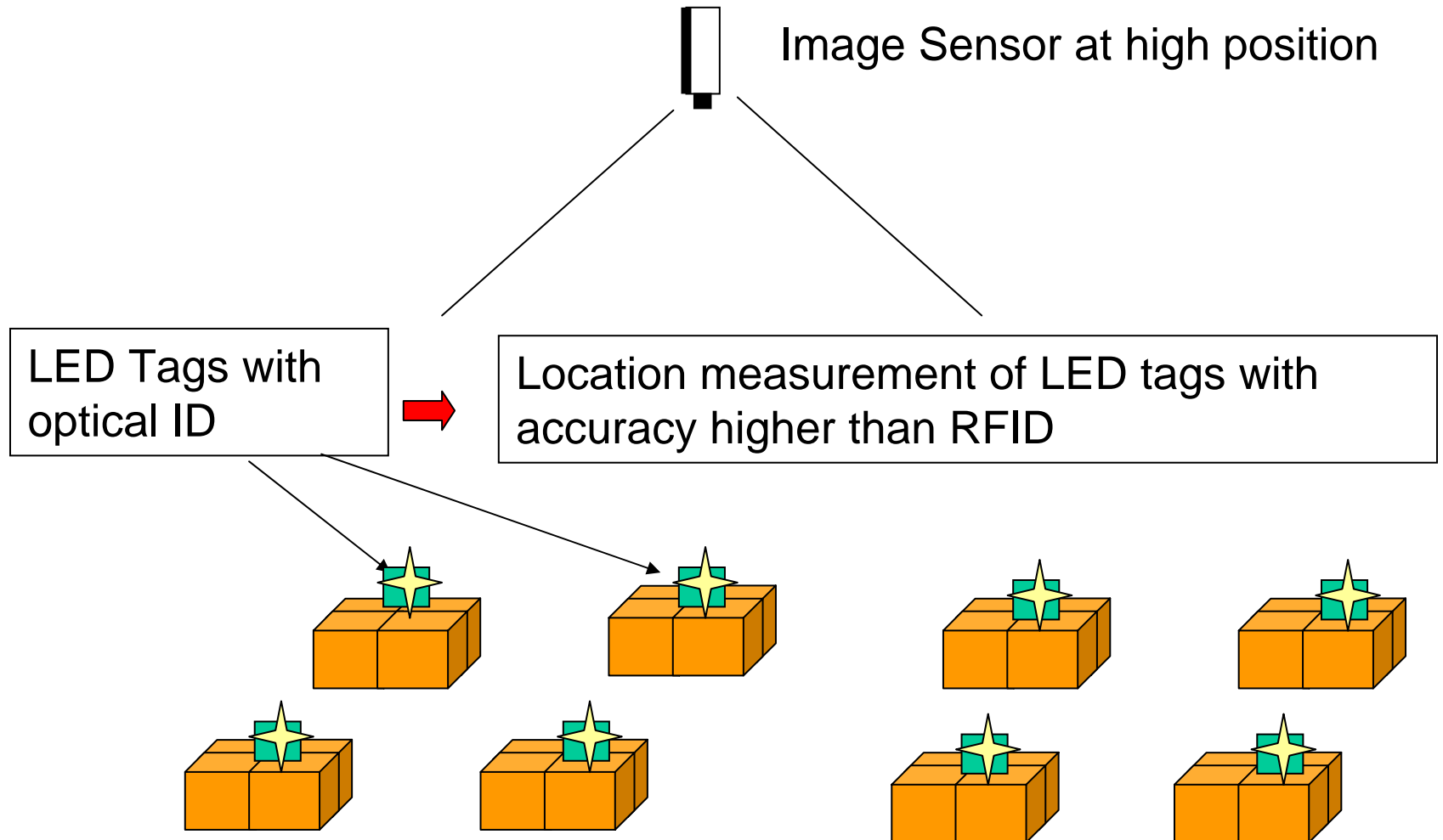
Shuji Suzuki

NEC

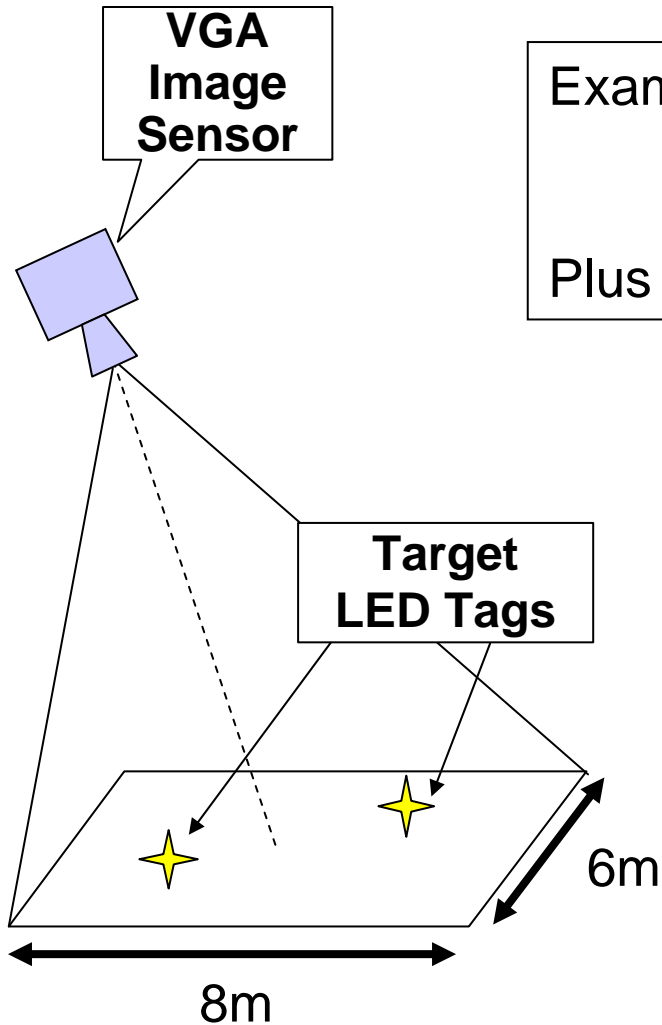
Image Sensor Use case



Application for Warehouse Management



Location measurement accuracy



Example: 640 x 480 pixels (VGA) resolution

→ 1.25cm resolution for 8m x 6m

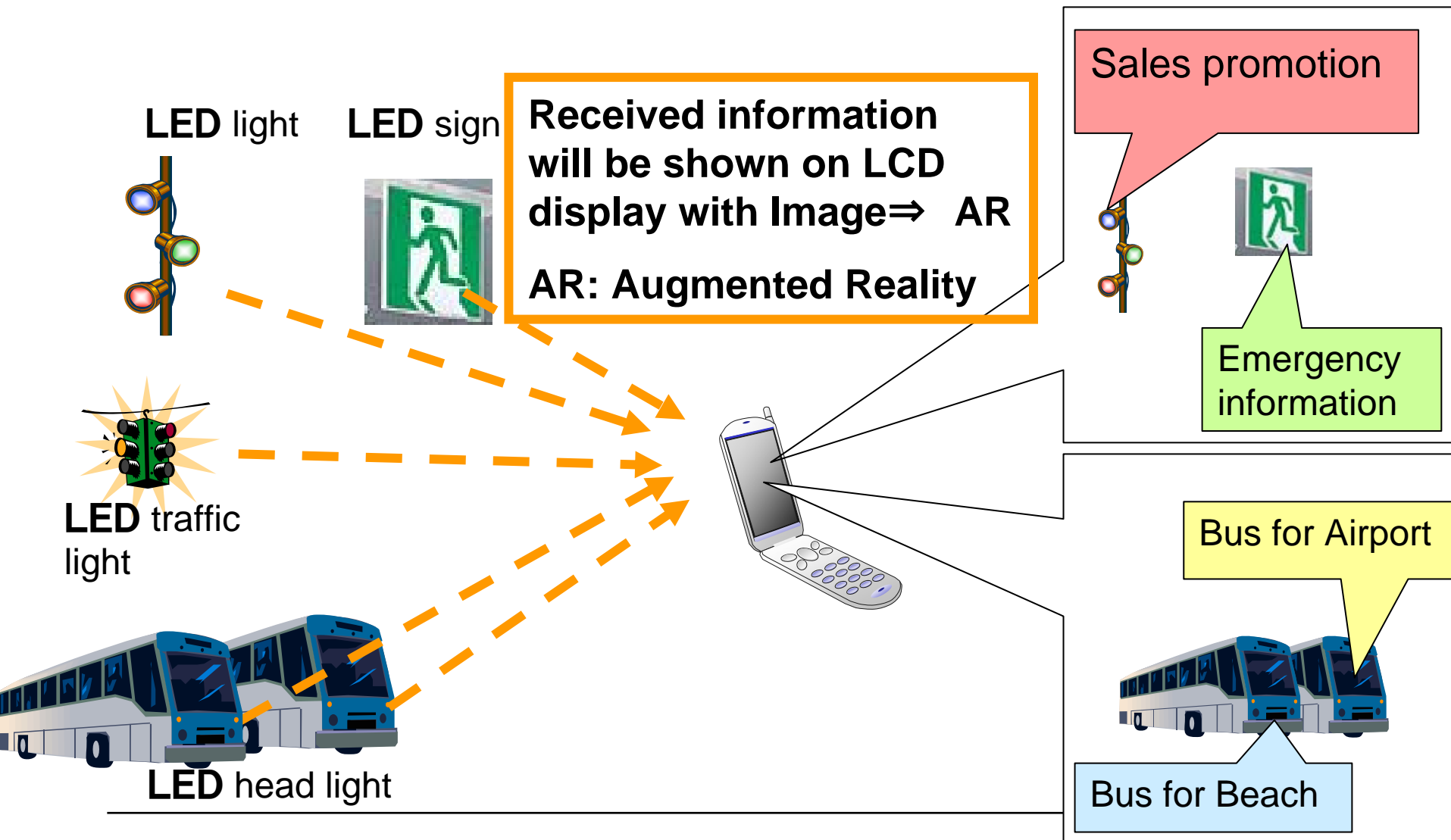
Plus Measurement error of distortion by optical lens

Experimental Results

5cm resolution for 8m x 6m plane with equalization software for lens distortion

Pretty good measurement accuracy

Image sensor in future mobile phone



Optical signal receivers

1. Photo diode

Already used for free-space optics receiver (IrDA etc.)

Easy to receive high-speed optical signal

Limited space-division selectivity

→ Weakness for Interference light

2. Image Sensor:

Optical receiver with position detection

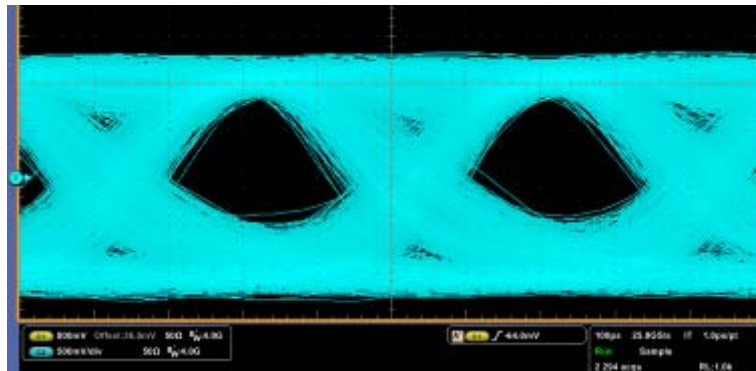
Capability of interference rejection

Low dependency for transmission distance

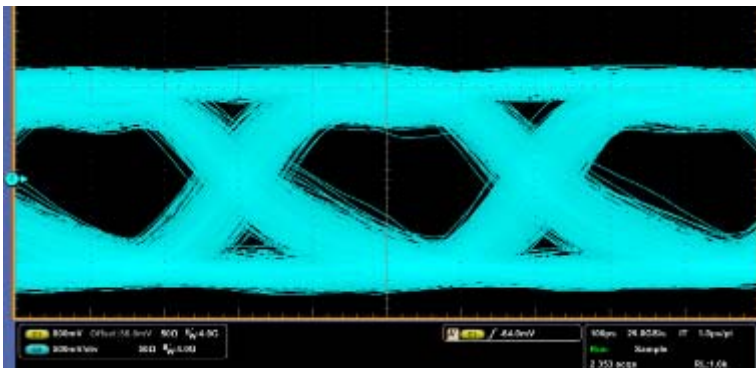
Limited frame-rate → Limited LED signal speed

Example of VL high-speed transmission

Received optical waveform 2.5 Gbps
650nm Laser Diode



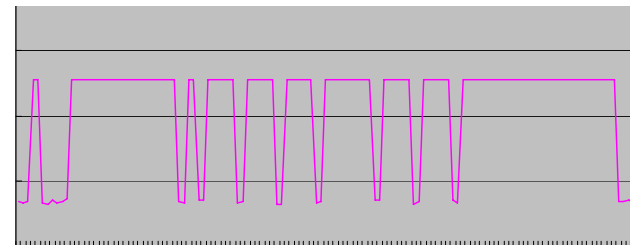
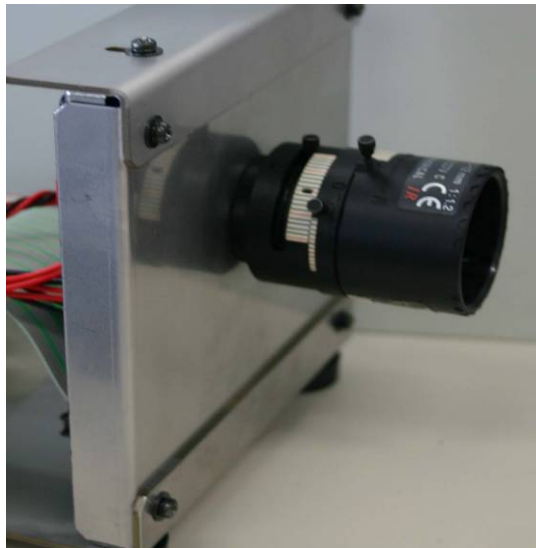
Received optical waveform 2.5 Gbps
780nm Laser Diode



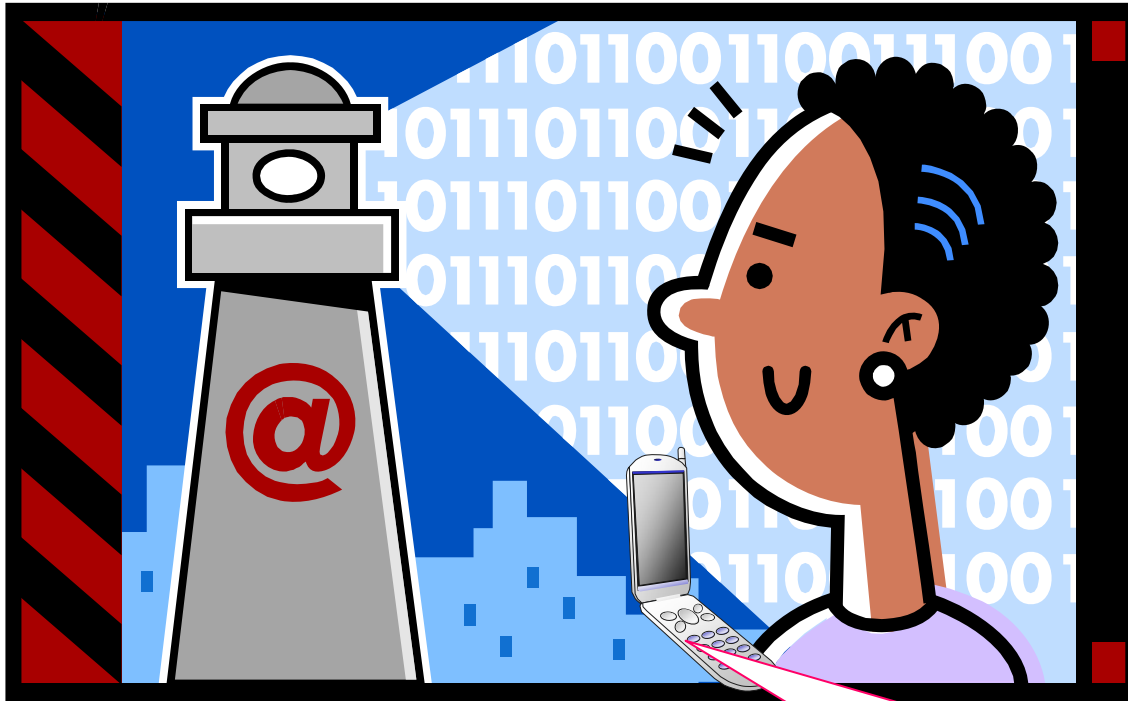
**Error free for
10cm
transmission
experiment**

Example of High-speed Image Sensor

2400 fps Image Sensor is used to receive 1200bps Optical Signal



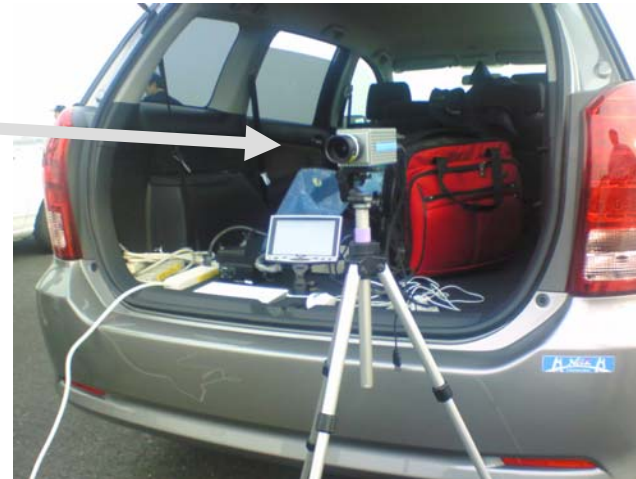
LED Light house: (70% of Japanese Light house)



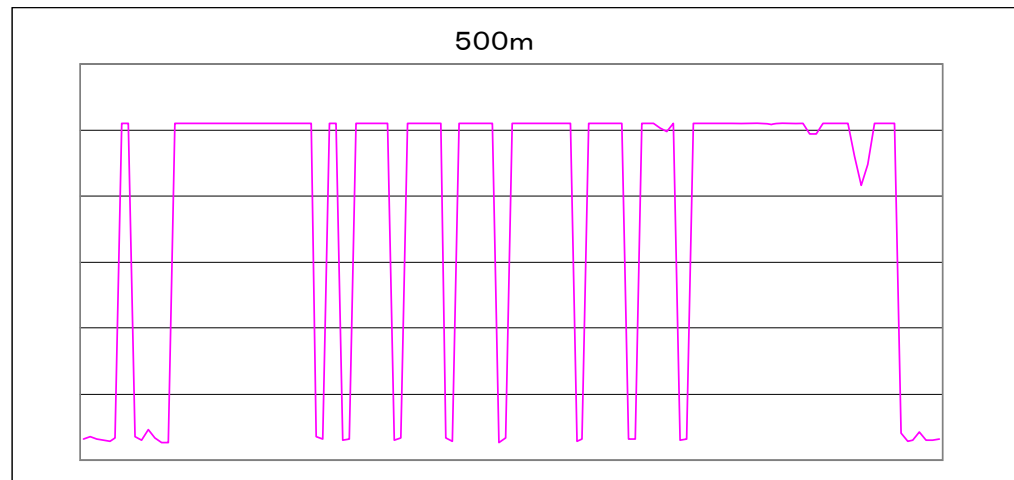
Weather forecast
Tidal wave
Sea condition

500m Transmission Experiment

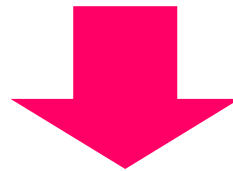
Image Sensor



Received Optical Signal Waveform

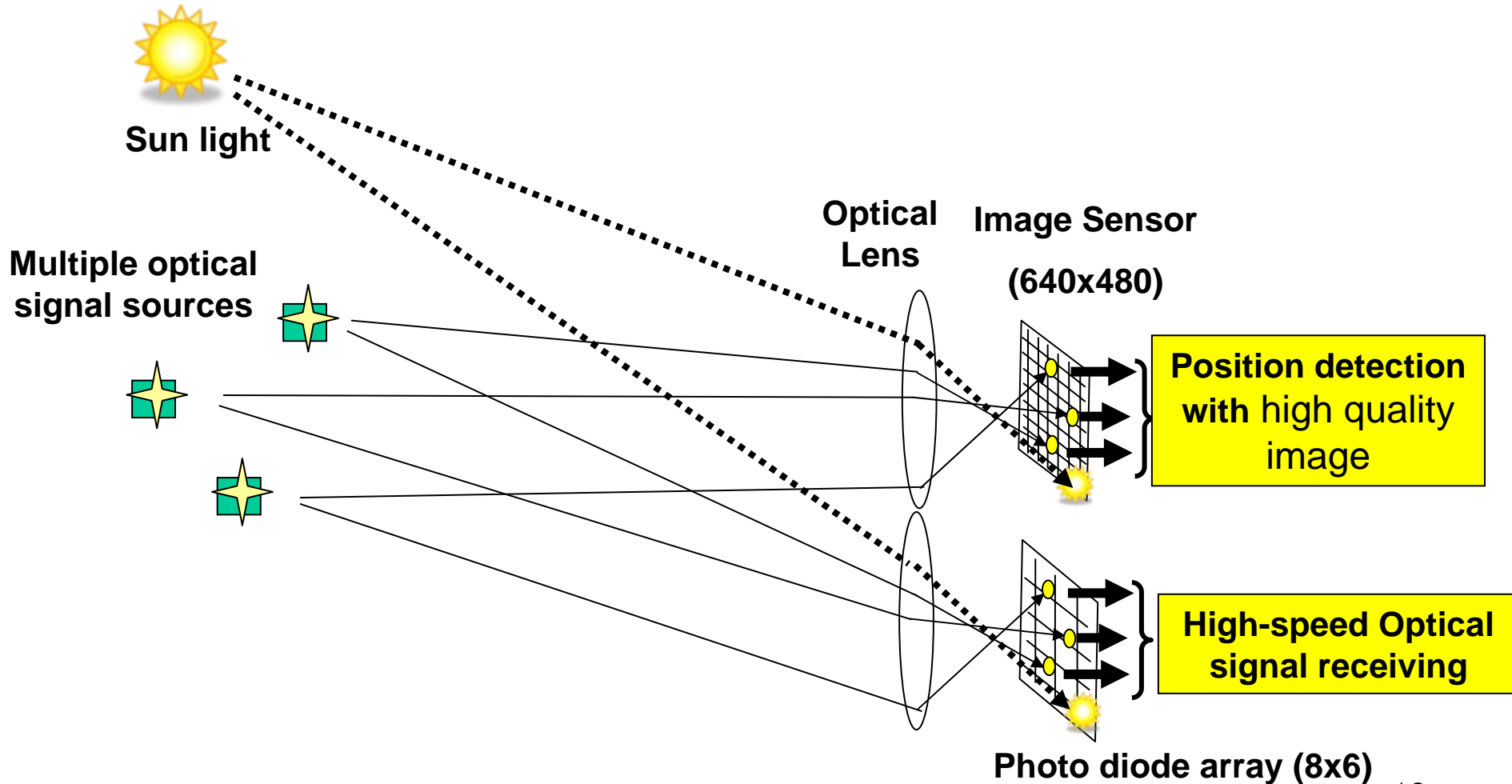


Is there any solution to take advantage of Image sensors and photo diodes ?

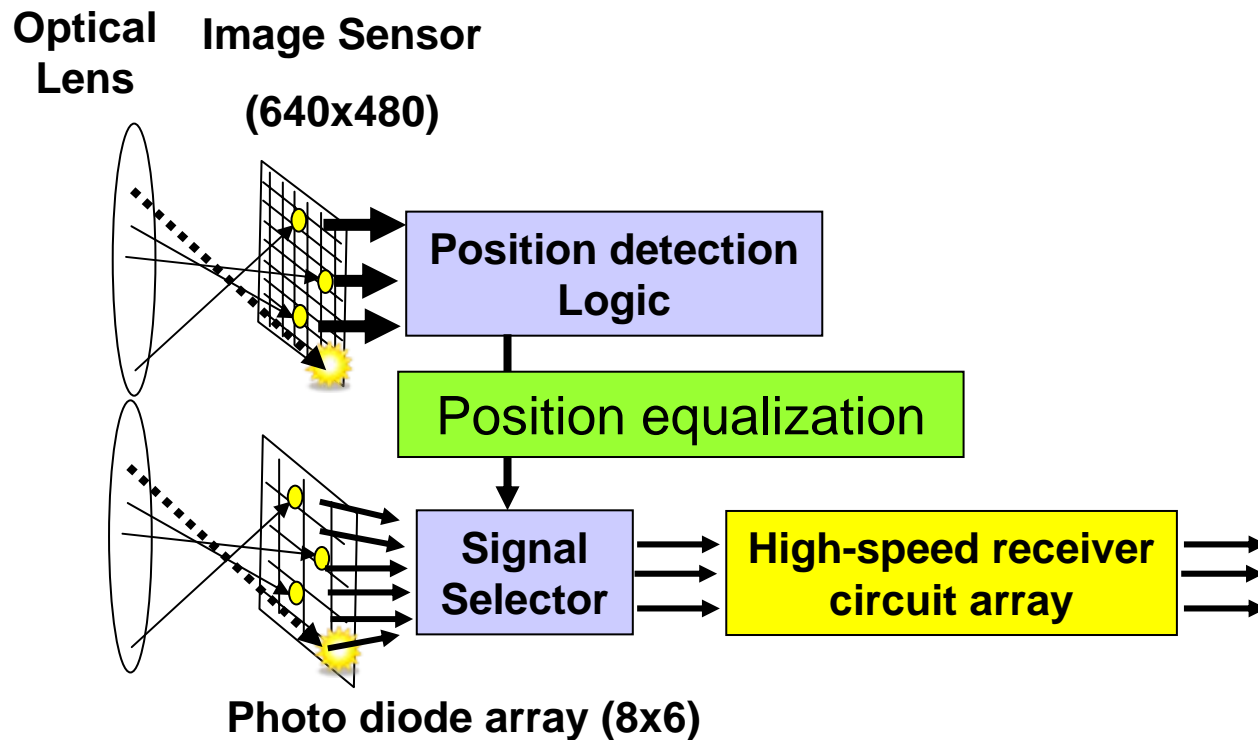


Possible Solution: Hybrid of Image sensors and Photo diode array

Hybrid of Image sensors and Photo diode array



Possible structure of Hybrid sensors





Q&A