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

Submission Title: [Location Information Technology by LED Tags and Image Sensors]
Date Submitted: [8 May 2008]
Source: [(1)Shuji Suzuki, VLCC/NEC]
Address [(1)1753 Shimonumabe Nakahara-ku Kawasaki 211-8666 Japan]
Voice:[(1)81-44-396-2245]
E-Mail:[(1) s-suzuki@dl.jp.nec.com]

Re: []

Abstract: [The overview of the image sensor for optical signal and position detector. The example of application systems also are presented.]

Purpose: [Contribution to IEEE 802.15 SG-VLC]

Location Information Technology by LED Tags and Image Sensors

2008.05

VLCC / NEC

Contents

- Optical signal detection by Image sensor
- Advantage and disadvantage of Image sensor
- Frame structure of optical ID
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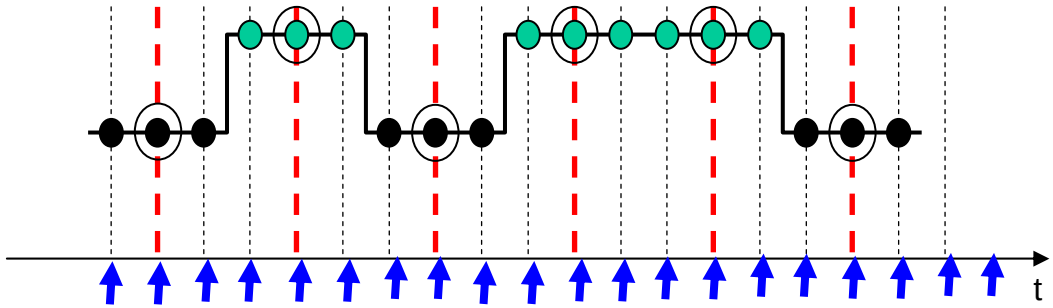
- Location measurement accuracy
- Comparison of location measurement technology

Optical signal detection by Image Sensor (Video Camera)

Optical signal of LED Tags



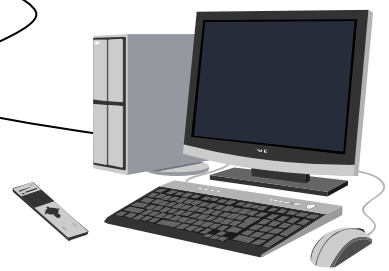
Sampling by Image sensor

LED Tag

Optical signal bitrate:40bit/sec

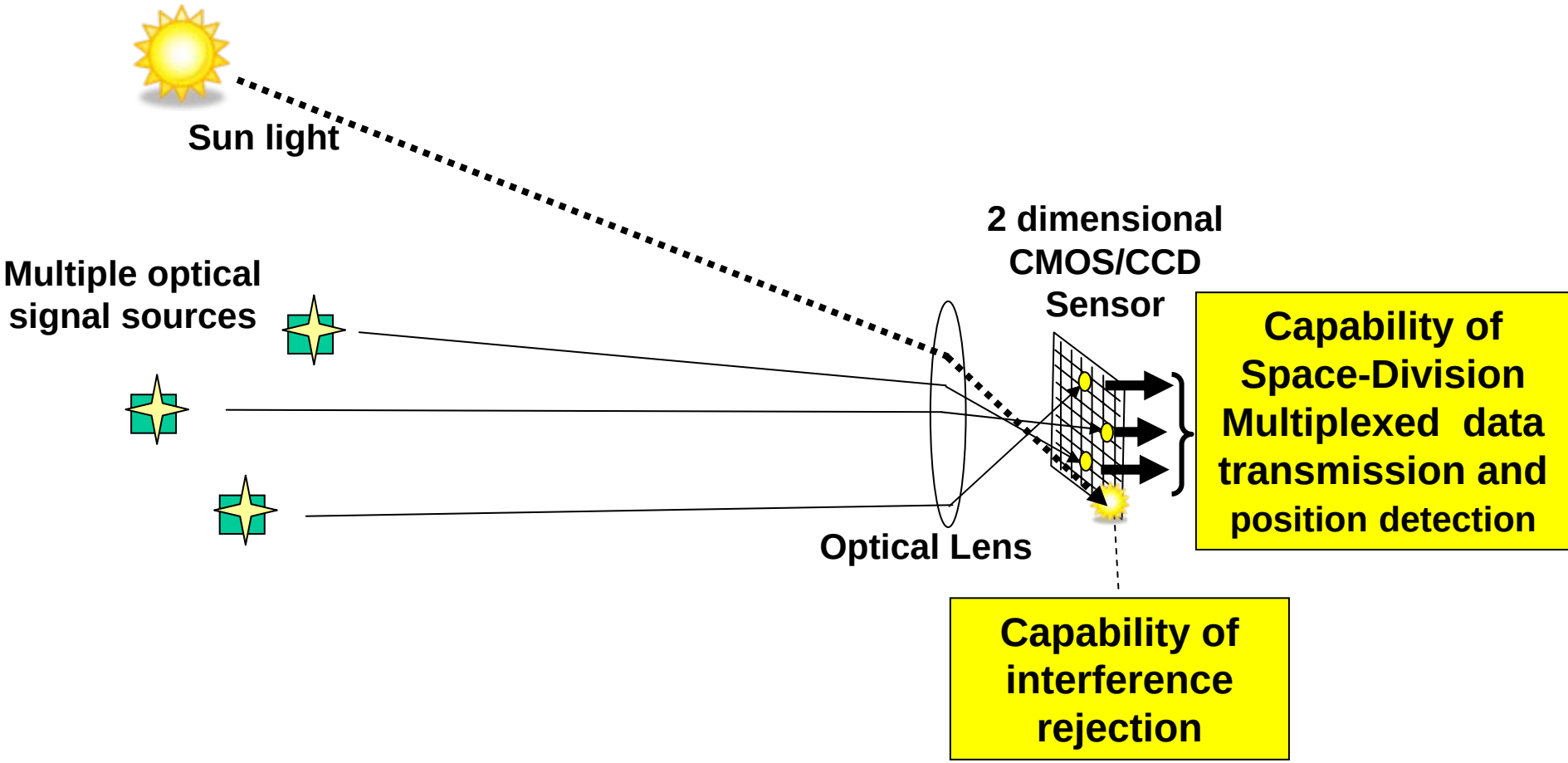
Image sensor :

120fps (frame per second)



PC for signal processing

Advantage of Image Sensor as an Optical signal detector

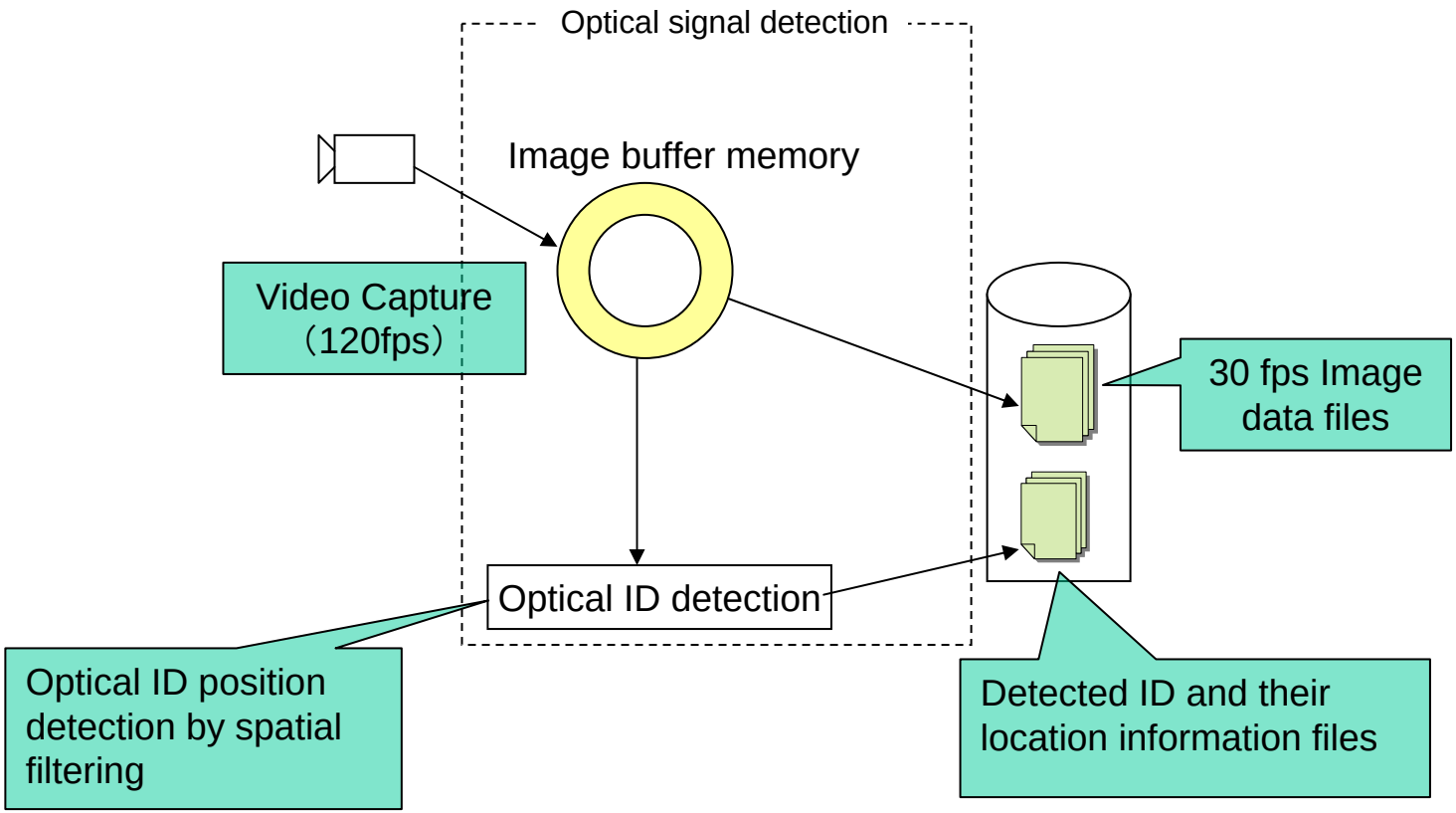


Disadvantage of Image Sensor : Low signal speed

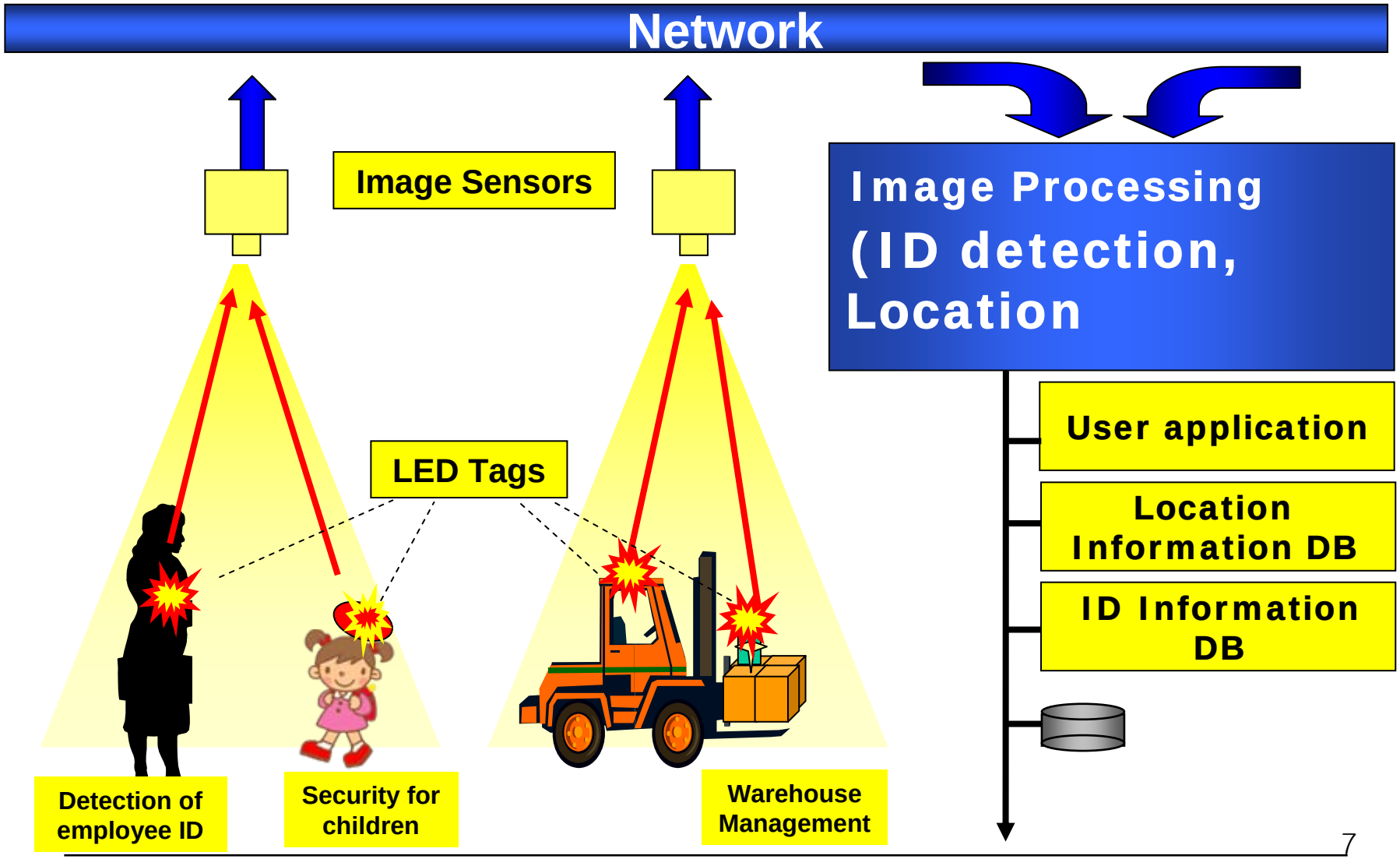
Example of optical ID Frame structure

SOP(Start Of Packet)	8bit	Fixed pattern
ID	24bit	Arbitrary data
CRC	8bit	Cyclic Redundancy Check

Signal processing block-diagram



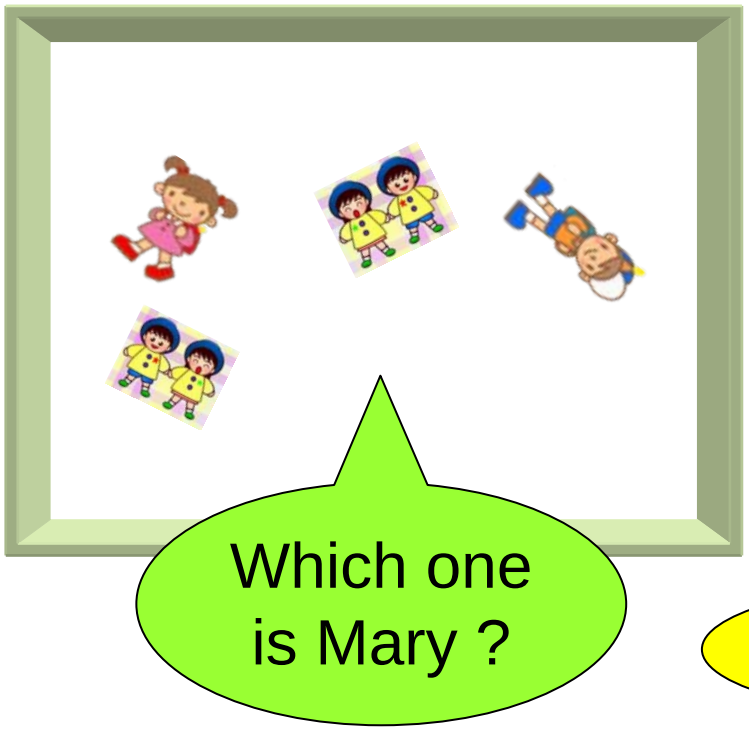
Application system overview



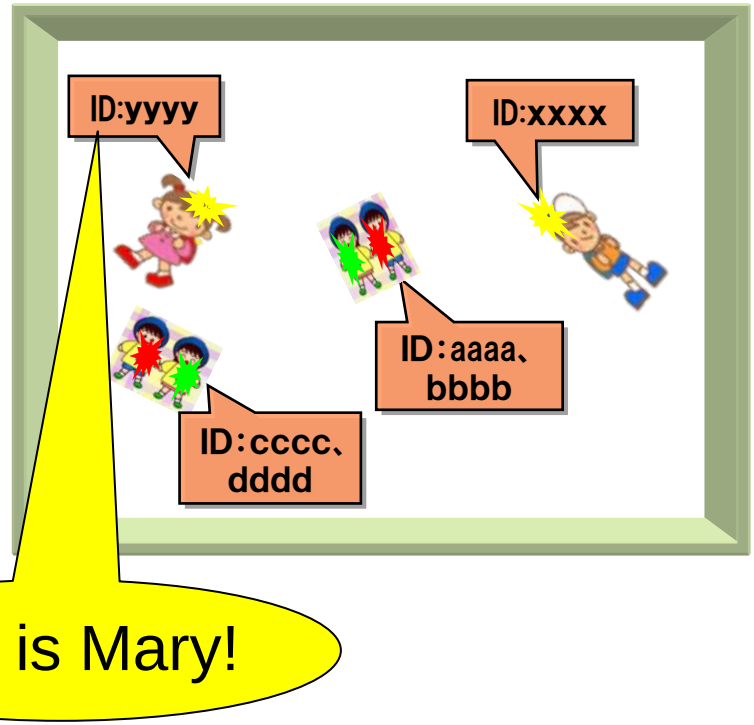
Application of Security for children

Image sensor = Optical ID reader + Video Camera

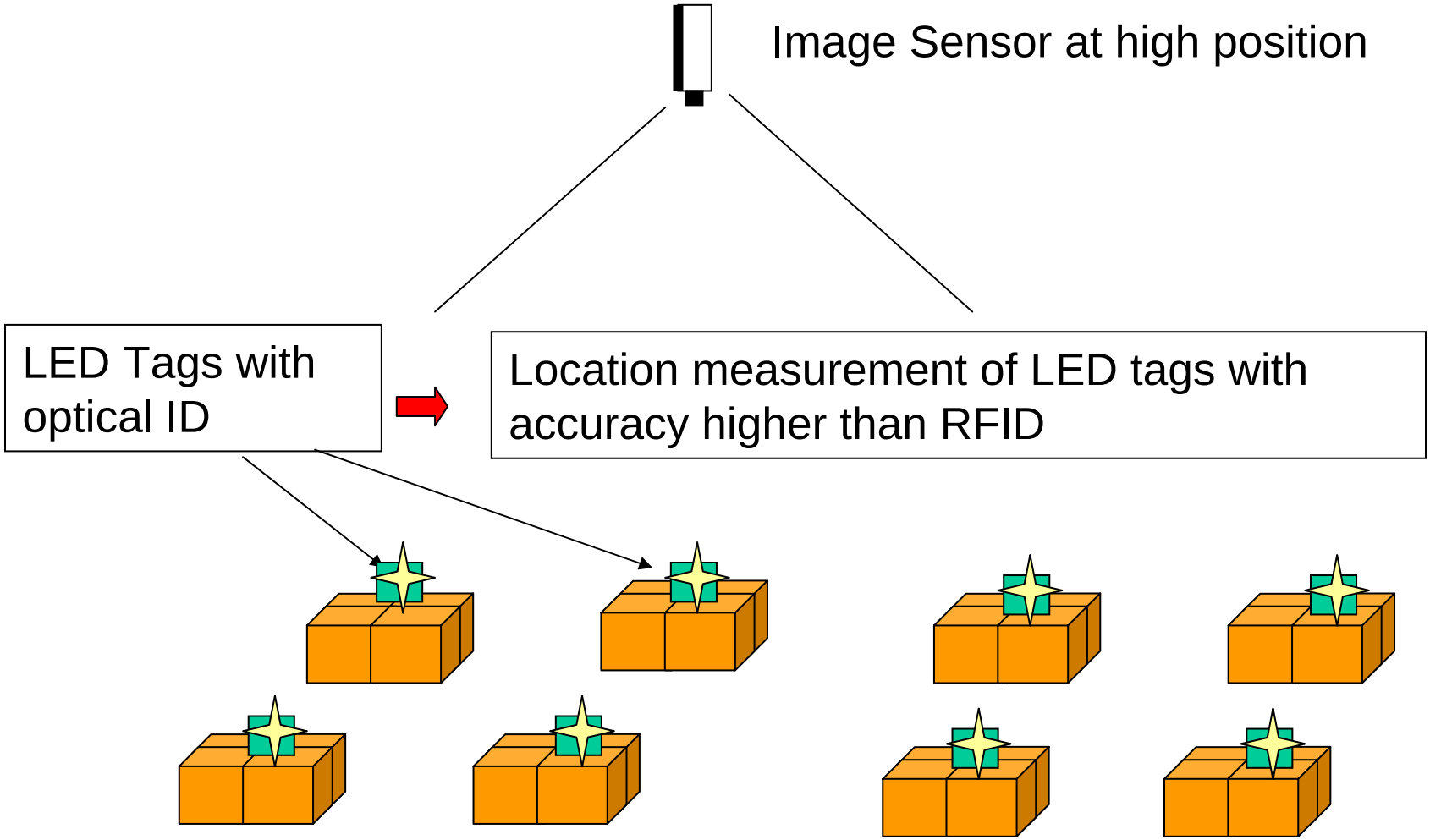
RF－ID + Security Camera



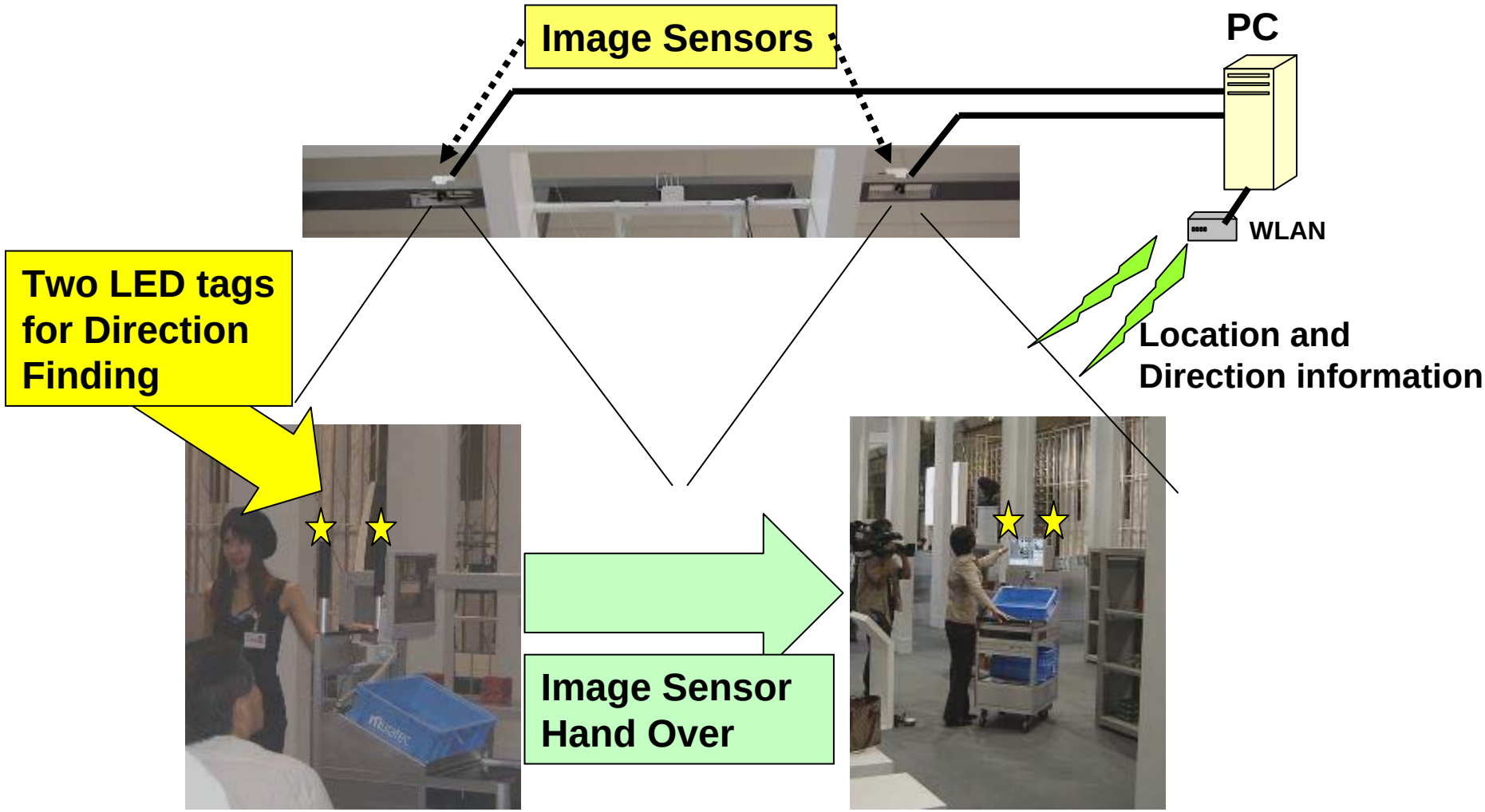
LED tags + Image sensor



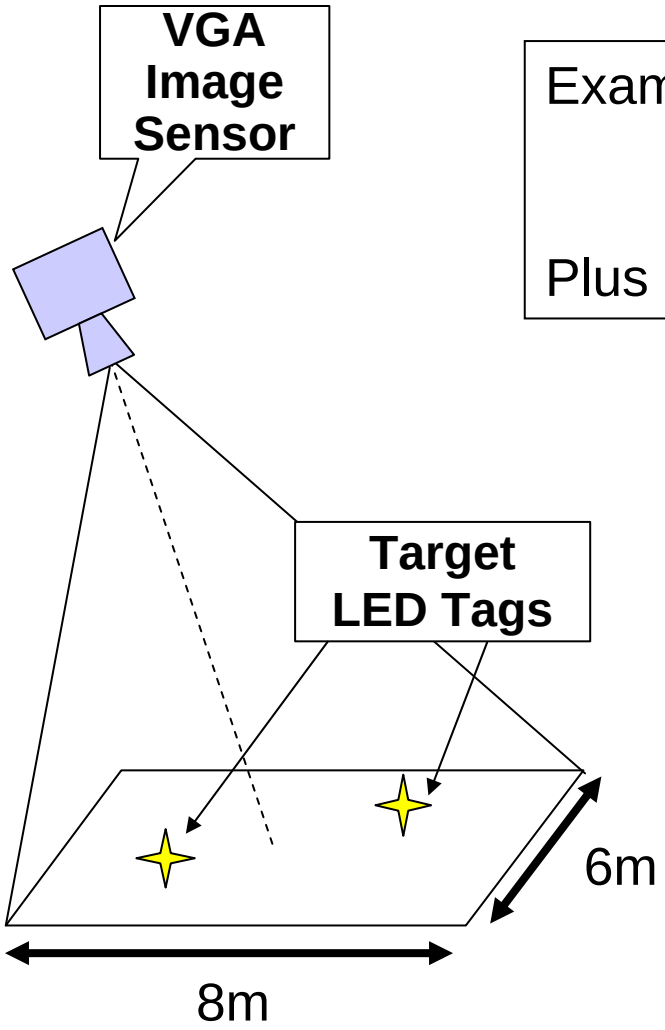
Application for Warehouse Management



Demonstration of Warehouse Management



Location measurement accuracy



Example: 640 x 480 pixels (VGA) resolution

→ 1.25cm resolution for 8m x6m

Plus Measurement error of distortion by optical lens

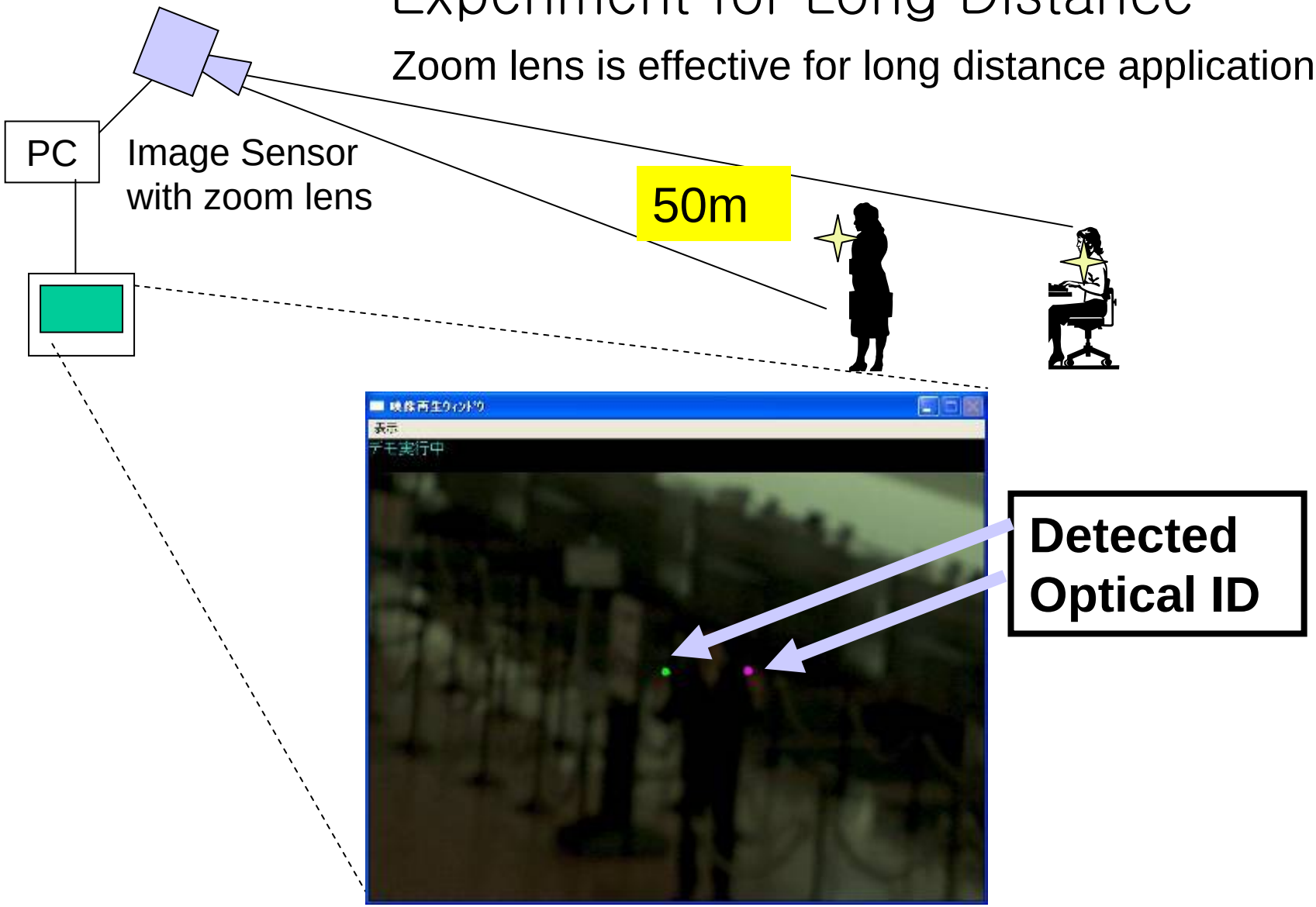
Experimental Results

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

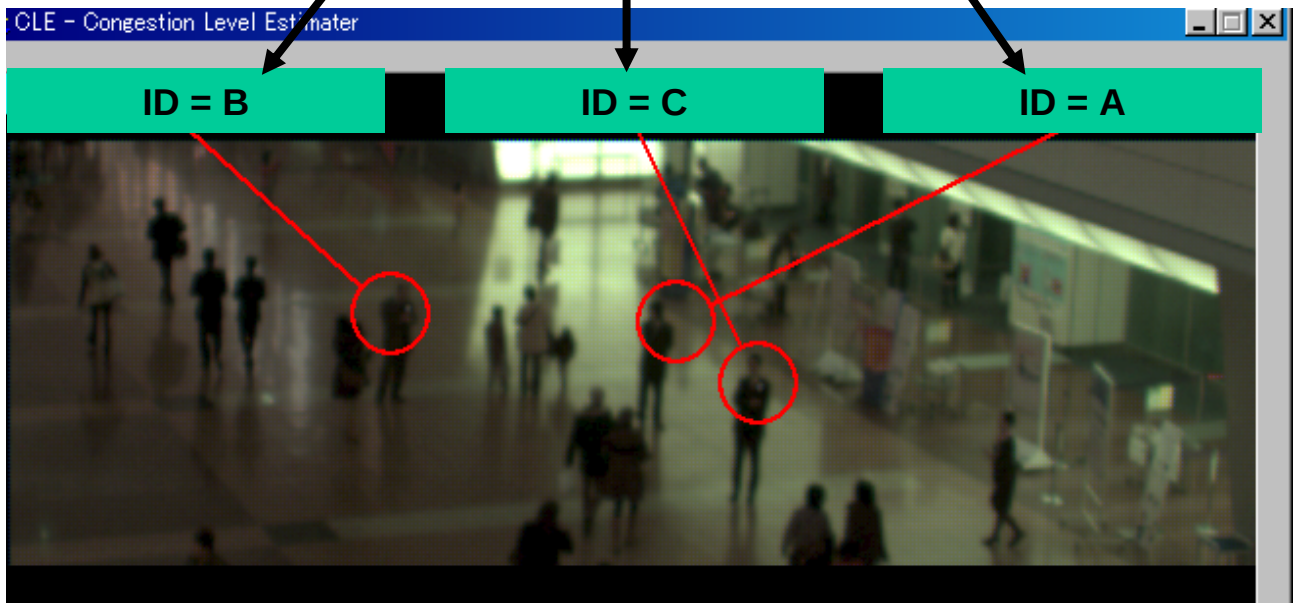
Pretty good measurement accuracy

Experiment for Long Distance

Zoom lens is effective for long distance application



Example of Employee ID detection



Comparison of Location Measurement Technology

	RF	Image Sensor
Accuracy	△	○
Effect of direct blinders	○	×
Effect of metric circumstances	×	○
Measurement system stability	○/X	○/X

Depend on RF transmission circumstance

Just avoid direct blinders !

Q&A