ITRI

Industrial Technology
Research Institute

ITRI Visible Light Communication Status and Trends

Information and Communication Research Laboratories

Optical Communications & Networking Technology Department

Speaker : Yen-Liang Liu

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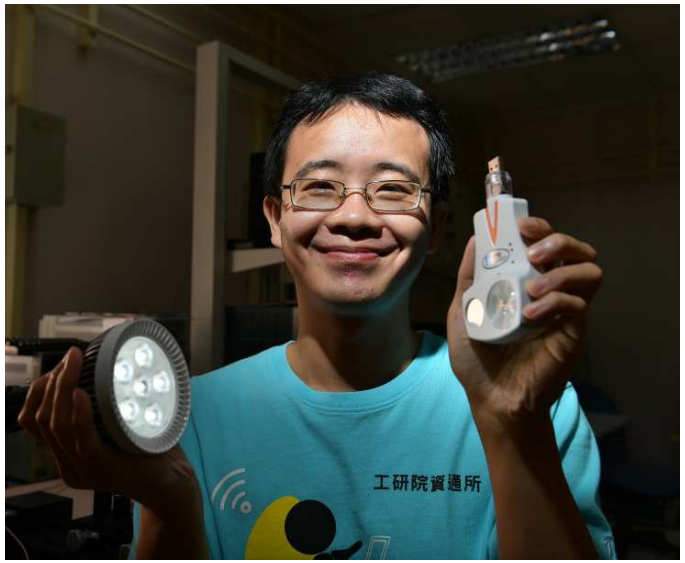
Self-Introduction



Yen-Liang Liu Deputy Technical Manager

Optical communication & Networking Technology Dept.
Information and Communications Research Laboratories

2005 : Joined Information and Communications Research Laboratories

2005 : Developed Advanced Telecom Computing Architecture for EPON OLT System

2008 : Developed Radio over Fiber Optical transceiver Design

2009 : Developed Pizza Box(1U) GPON OLT System

2011 : Developed Visible Light Communication

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EPON : Ethernet Passive Optical Network
GPON : Gigabit-Capable PON
OLT : Optical Line Terminal

ITRI Innovation

Total Staff: 5,573

- PhD: 24%
- Master: 54%
- Bachelor: 22%
- Alumni: 22,202

Total Patents

- 20,636

Start-ups

- Spin-off: 72
- Incubated: 174

ITRI Core Competencies

Information and Communications

Electronics and Optoelectronics

Green Energy and Environment

Material and Chemical

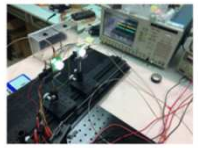
Biomedical Technology and Device

Mechanical and Systems

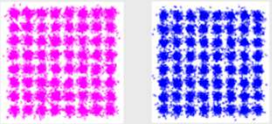
ITRI ICL Visible light Communication Roadmap

- R/G/B/V for MB DFT-Spread-OFDM Modulation (2.96G/ 3m) ➔ 2016
- White LED for MB DFT-Spread-OFDM Modulation (1.0G/ 1m) ➔ 2016
- Optical OFDM Modulation / Optical MIMO (784 Mbps/ 1m) ➔2015

Transmitter side

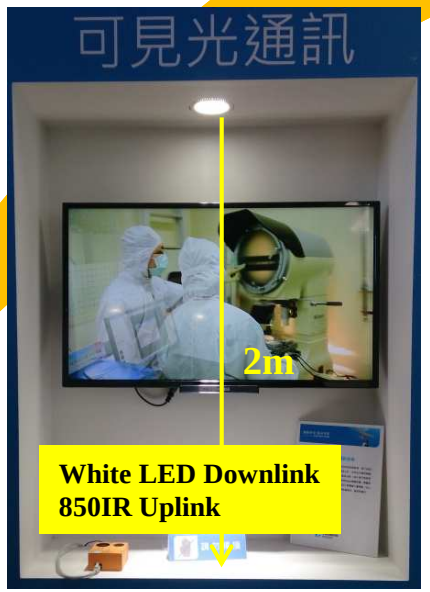


Receiver side

	Channel 1	Channel 2
Distance	1 m	
FFT/IFFT size	256	
Number of bands	1	
Signal bandwidth	82 MHz	86 MHz
Modulation format	64 QAM	64 QAM
Data rate	492 Mbps	516 Mbps
BER	2.4×10^{-3}	2.6×10^{-3}
Constellation		

*7% FEC threshold of 3.8×10^{-3} is assumed

- Date rate : 50Mbps/2.5m ➔2014
  2Mbps/2.5m ➔2012

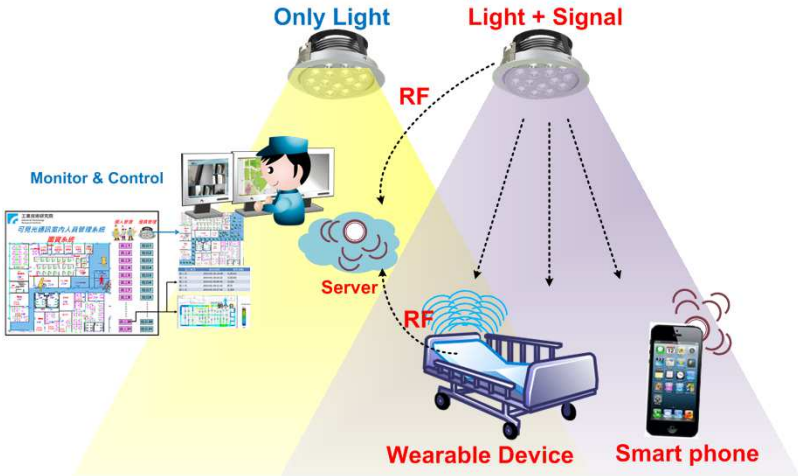


2011

begin research

- LED LBS Field Validation

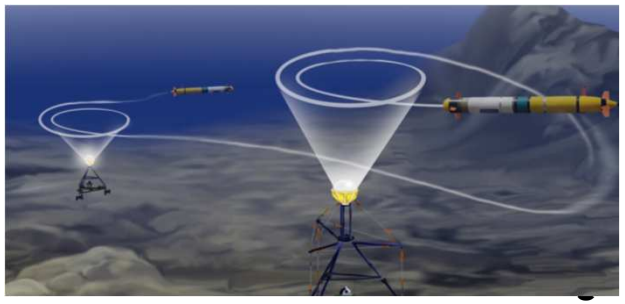
>5m	>3m	>3m	>2m
5000K	4000K	5900K	6000K



2017~2020

- White LED VLC (CMOS Image Sensor)
- Date rate : 40Mbps/2.5m

- Blue-Green VLC (PMT/ APD)
- Date rate : 20Mbps/20m



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ITRI ICL LED VLC Technology

Development trend	Technical features	Application
Broadband	• No EMI • License-Free • High Security for Network	
Localization	• Location based services system • Line of sight	
Underwater	• High speed communication in water • electromagnetic waves rapidly attenuation in water	

VLC Technology

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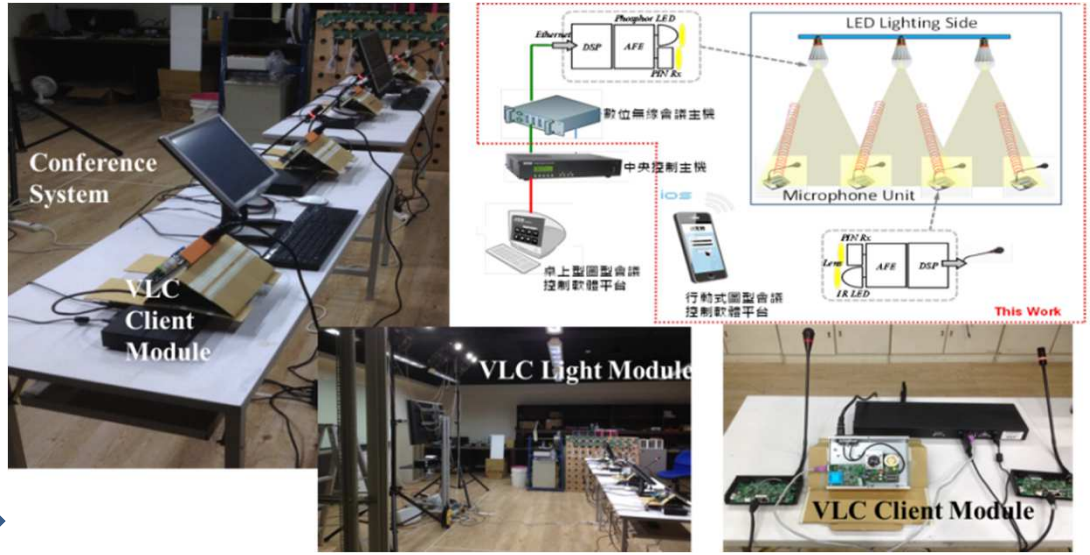
Contents

- **ITRI Visible Light Communication status of technology development**
- **Future ITRI Visible Light Communication Technology**

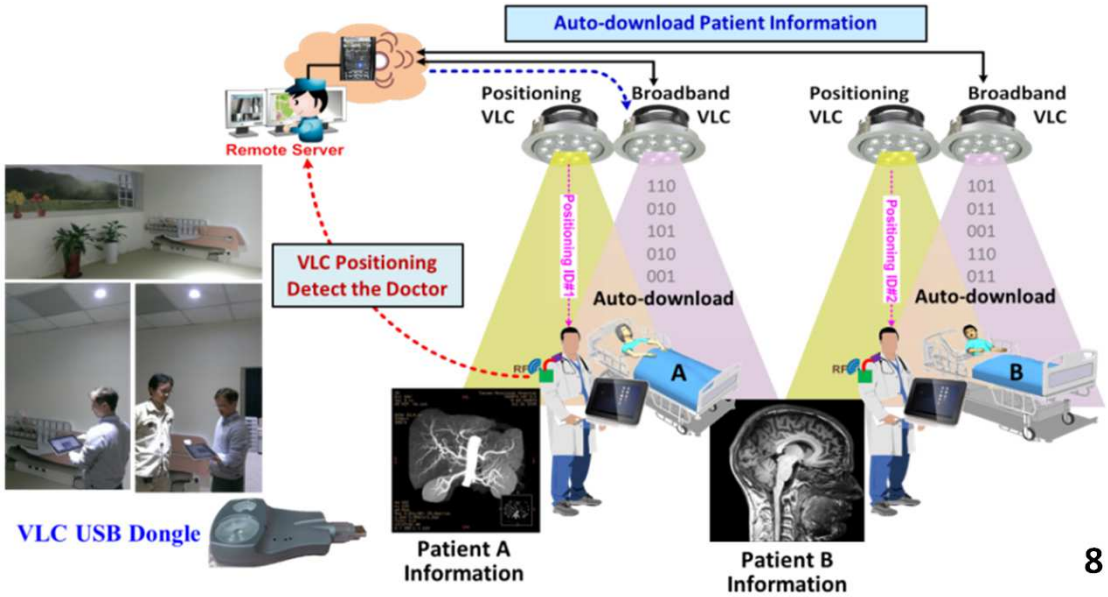
Broadband Bidirectional VLC-Link

Application

- **Secure Meeting Room Communication System**



- **Detect the doctor location → then automatically transmit the patient information**



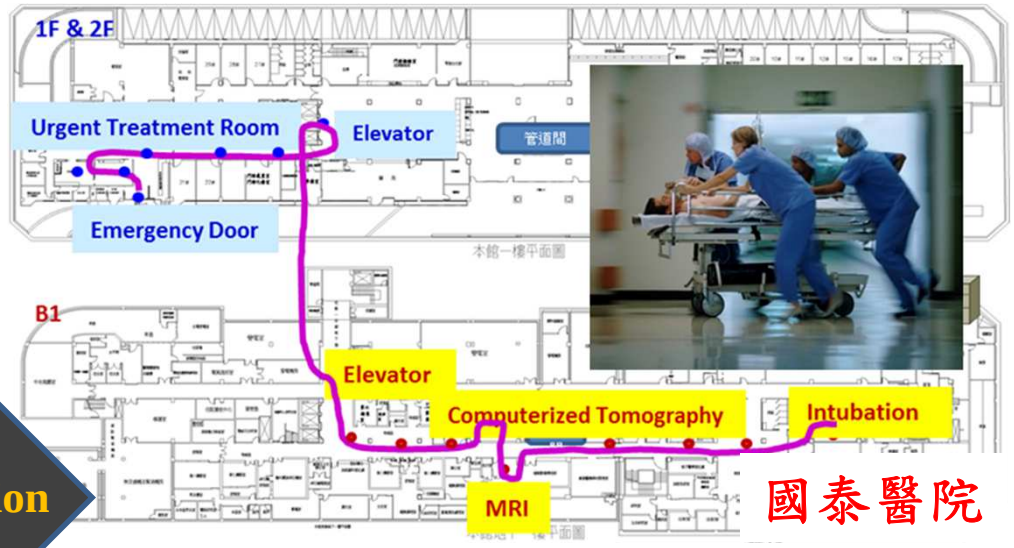
VLC Indoor Positioning System & Field Trial

- **Build Hospital VLC Field Trial to Support the Emergency Route Record**
  - Using VLC to achieve location-identification & treatment route record
  - Design the VLC indoor positioning management system

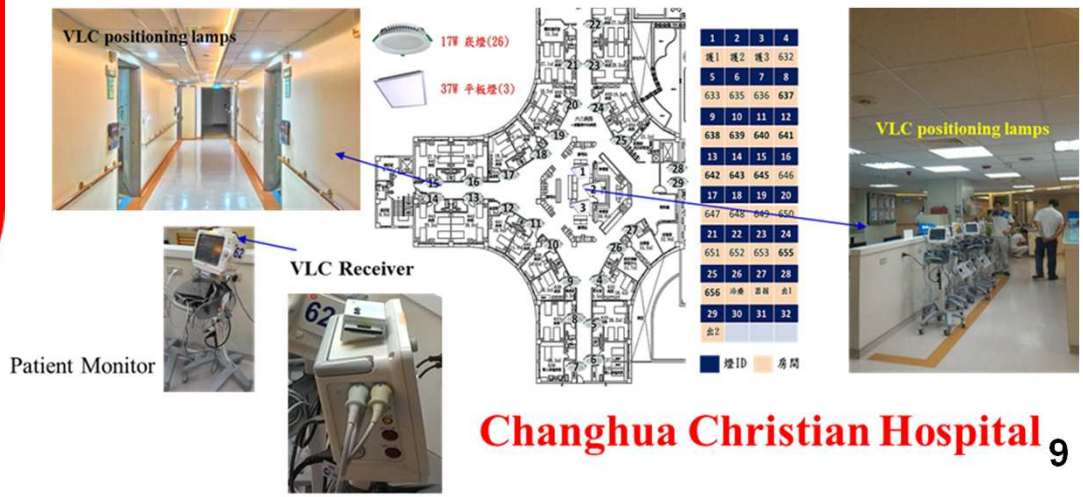
ITRI Demo Room

Application

VLC emergency routing and managing system



medical equipment tracking system at nursing station



Changhua Christian Hospital

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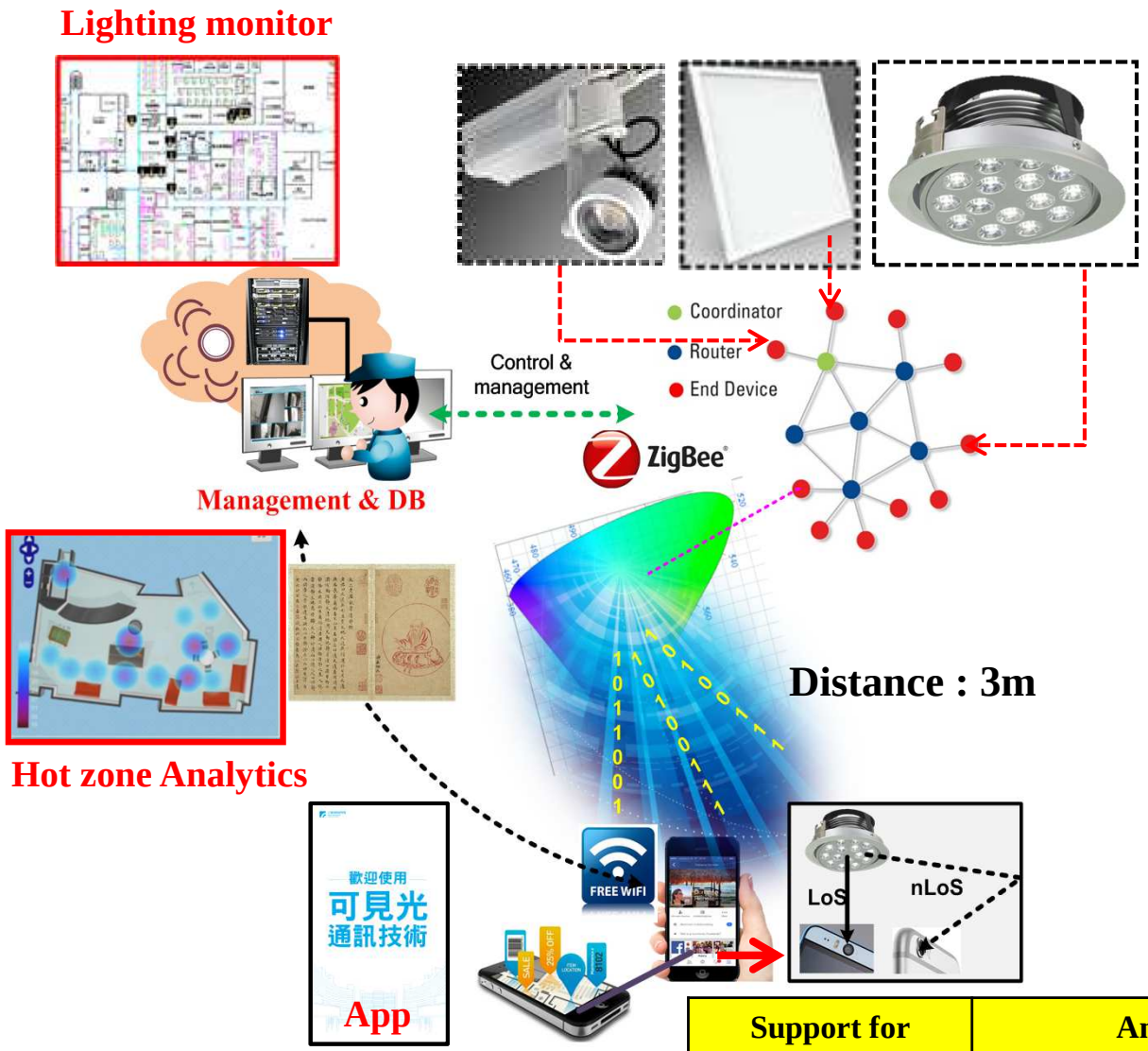
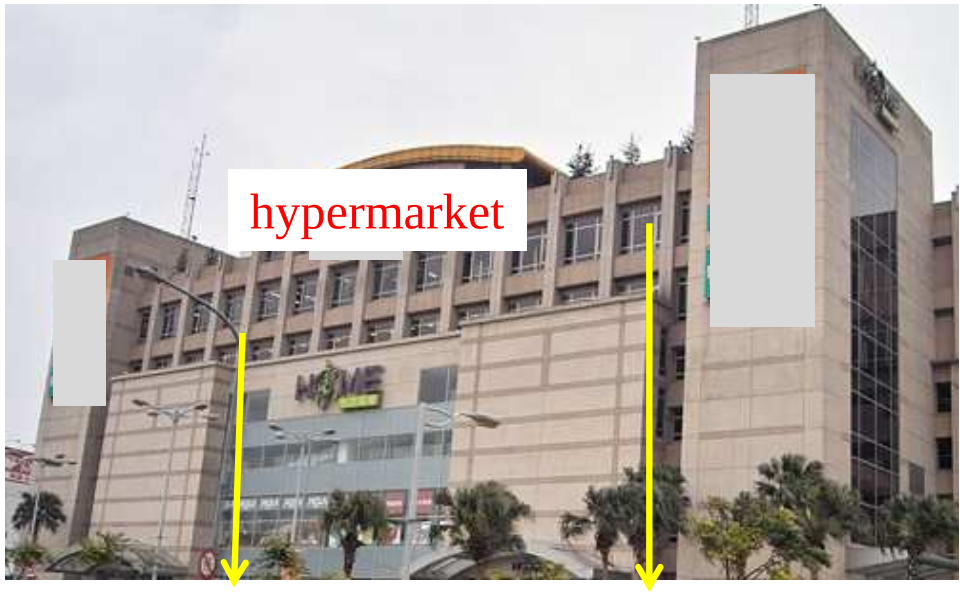
Smart Phone Based LBS System



Support for mobile phones	Android5.0 (Nexus) iOS7 (iPhone6/ 6s)

2017 Field Validation for Store



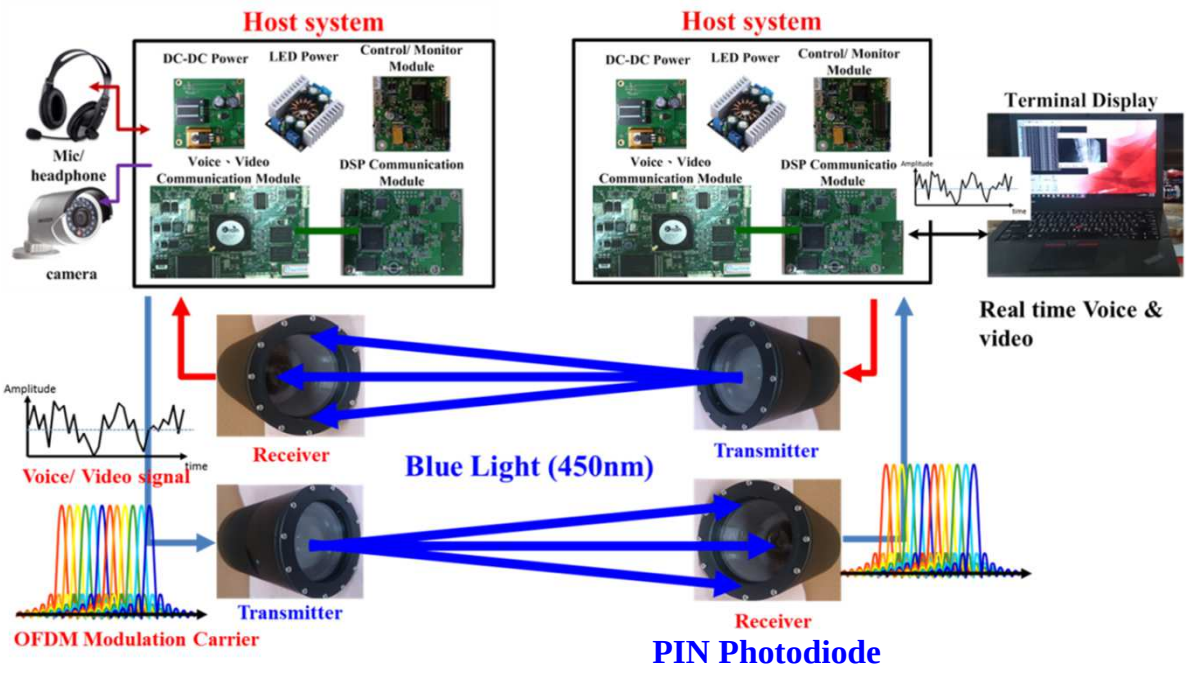
Promotion

Positioning

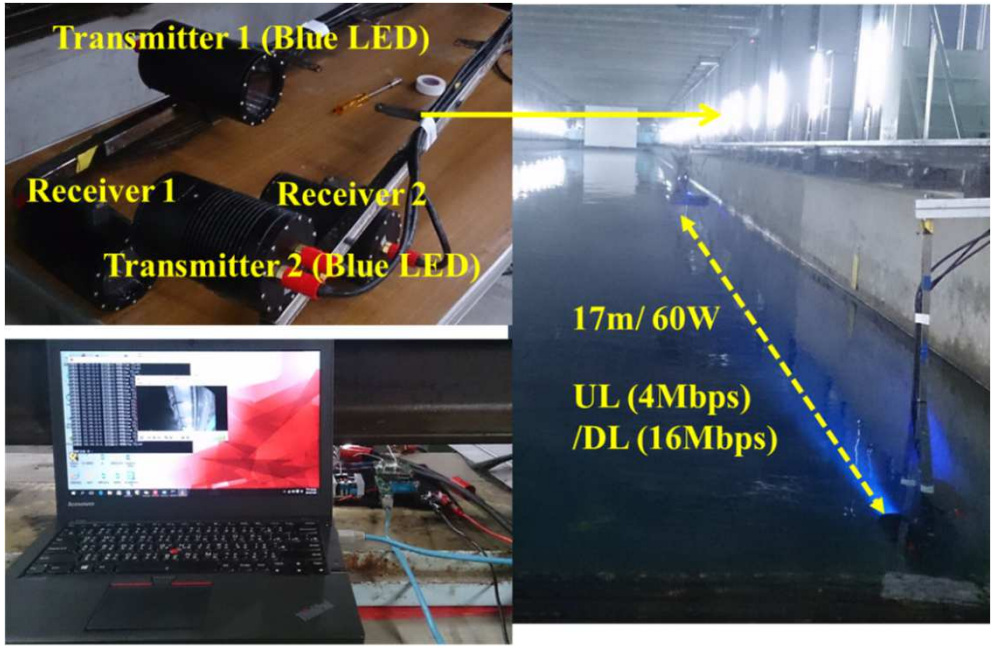
Contents

- ITRI visible light communication status of technology development
- **Future ITRI visible light communication technology**

Underwater Visible Blue-Green LED System

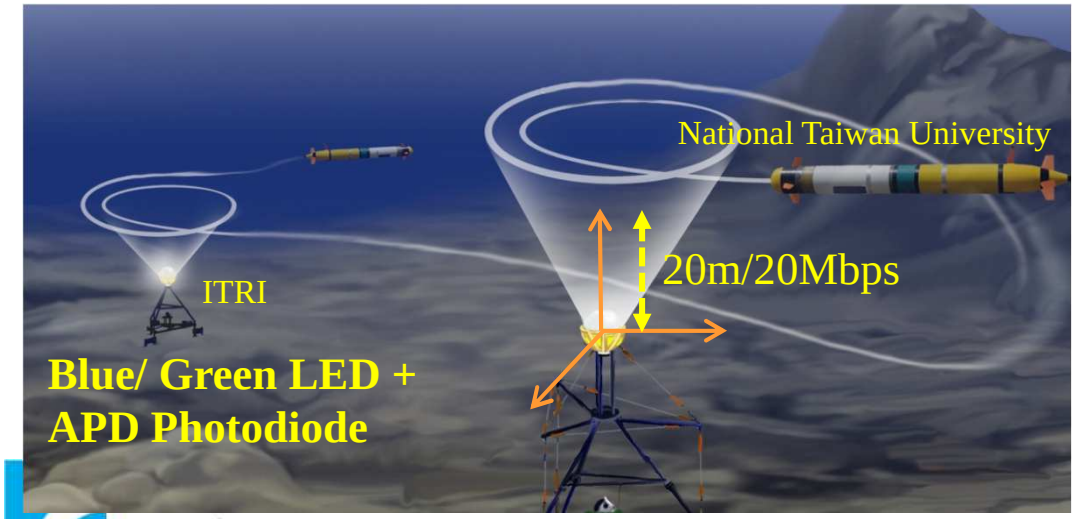


2016 Underwater VLC Test

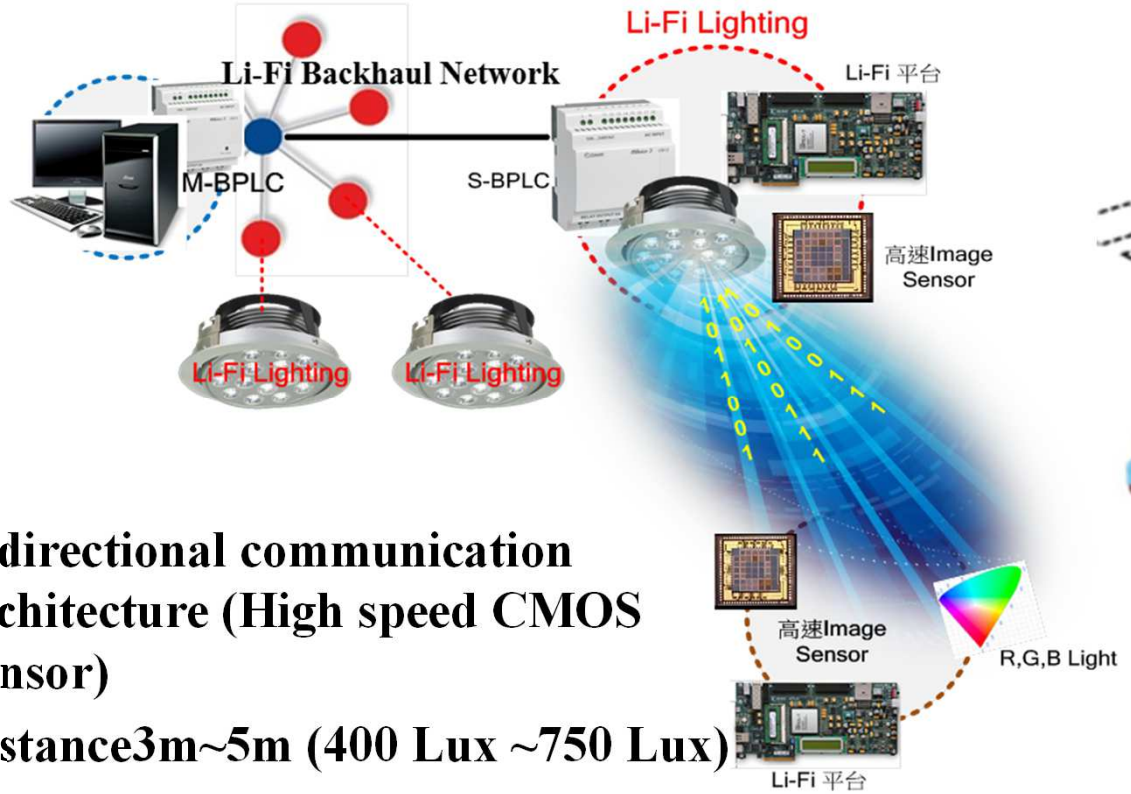


Real time Voice & video

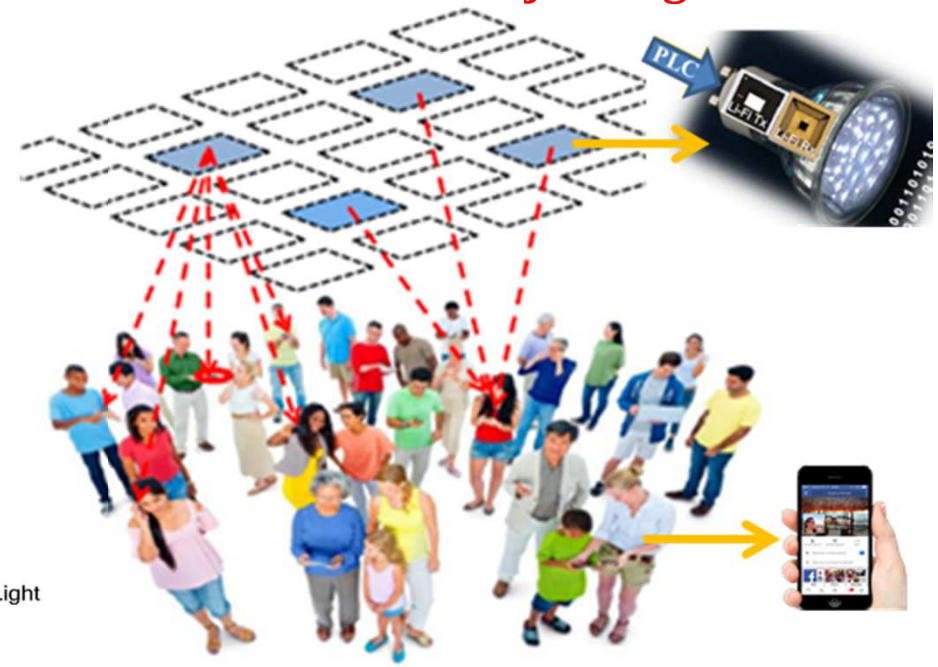
2018 Projector goal



CMOS sensor Based Broadband VLC Technology

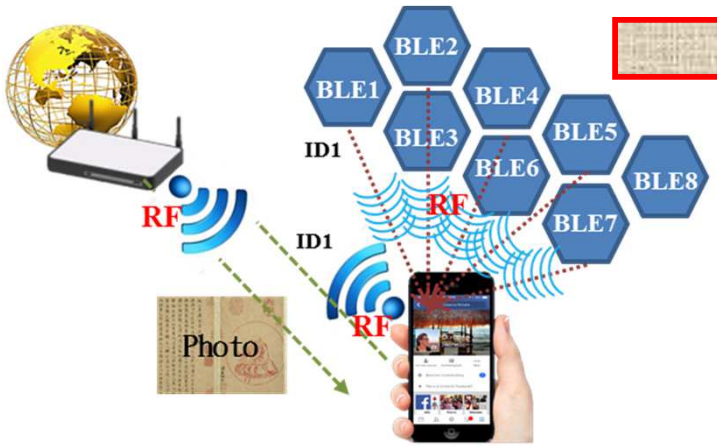


2018~2020 Projector goal



- **Bidirectional communication architecture (High speed CMOS Sensor)**
- **Distance3m~5m (400 Lux ~750 Lux)**
- **Transmission rate (DL:40Mbps;UL:1Mbps)**
- **Low latency**
- **BPLC module acts as a Backhaul network**

RF Based exhibition services



LED Based exhibition services

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