

ชุดพัฒนาระบบสื่อสารด้วยแสงสว่าง ตามมาตรฐาน CP1223

คทา จารุงศ์รังสี*, ผศ.เพชร นันทิวัฒนา**,
อ.เต็มพงศ์ ศรีเทศ*, รศ.ดร.ปรีชา กอเจริญ**

*ศูนย์เทคโนโลยีอิเล็กทรอนิกส์และคอมพิวเตอร์แห่งชาติ (NECTEC)

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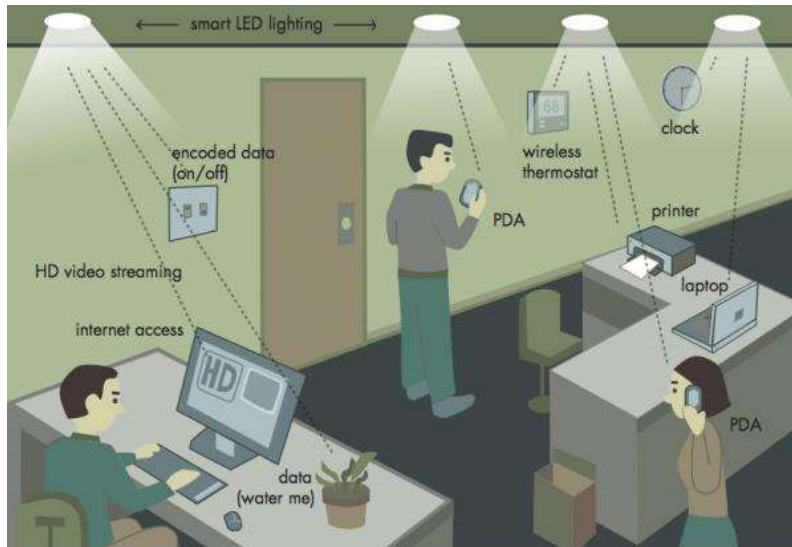
Visible Light Communication (VLC) ?

การส่องสว่าง + ข้อมูล

จุดประสงค์หลักเพื่อให้ความสว่าง
เพิ่มมูลค่าด้วยการสื่อสารข้อมูล

Indoor Broadband with VLC

Indoor broadband broadcasting in Hospital / Supermarket / University / Office



Source: Boston University



Source: Oxford University
(OMEGA project)

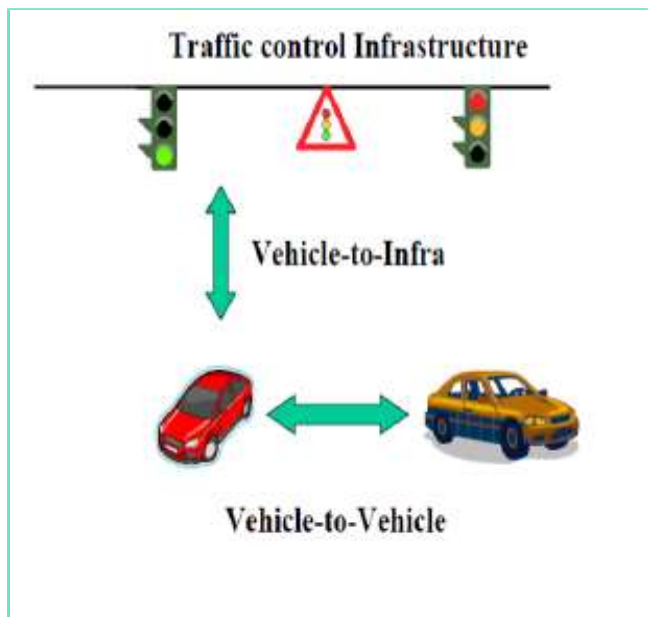
Super market promotion via VLC



The product information is acquired by the visible light receiver on the shopping cart.

Prototype presented by NEC and Matsushita Electric Works

Traffic Communications



M Kavehrad PSU, USA

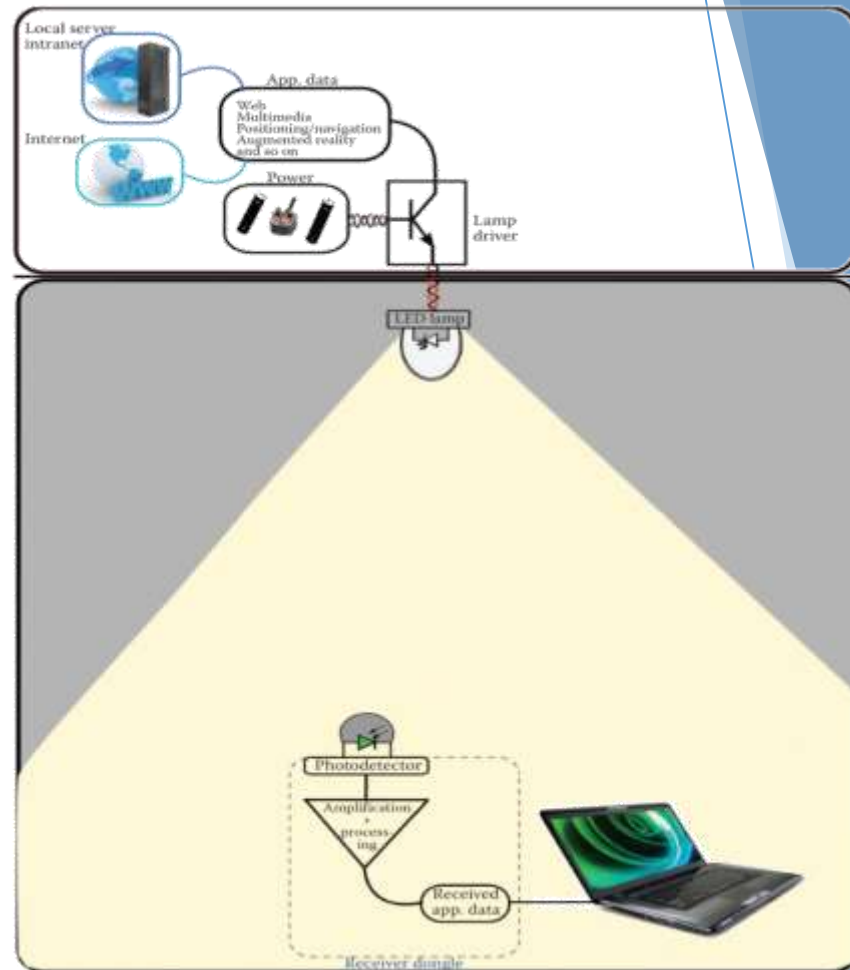


Source:

Hoa Le Minh and Zabih Ghassemlooy, Visible Light Communications, Optical Communications Research Group (OCRG), Northumbria University.



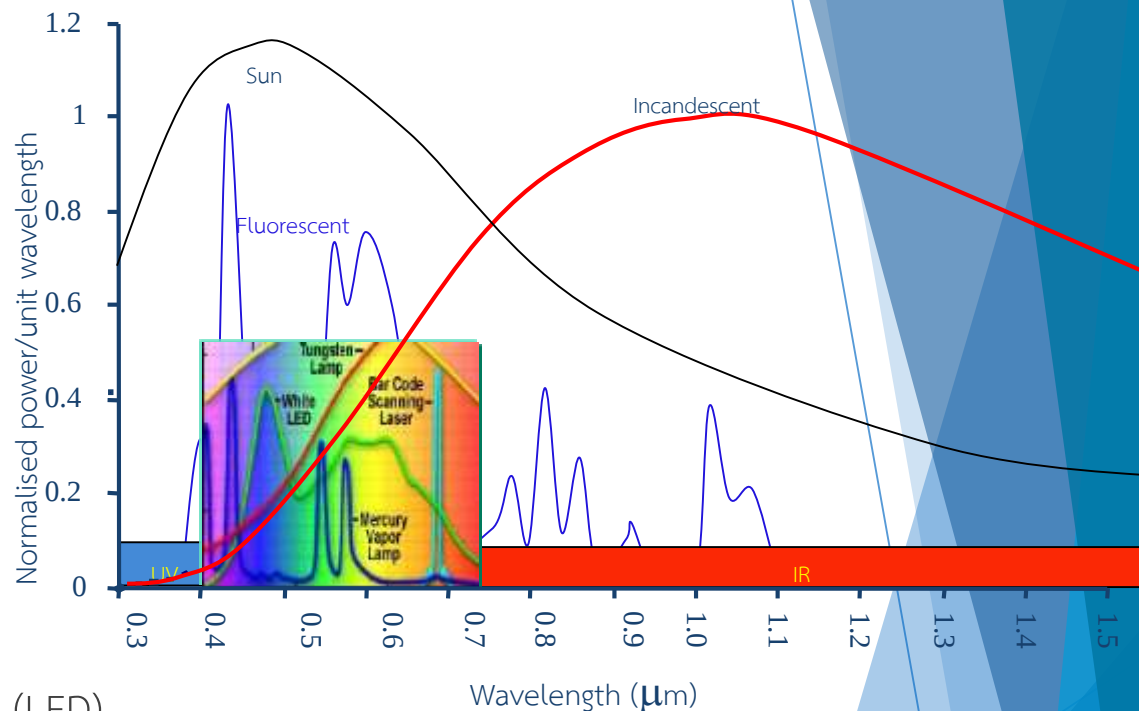
An illustration of the VLC concept



This is for the downlink only,
and a parallel similar system
is needed for the uplink.

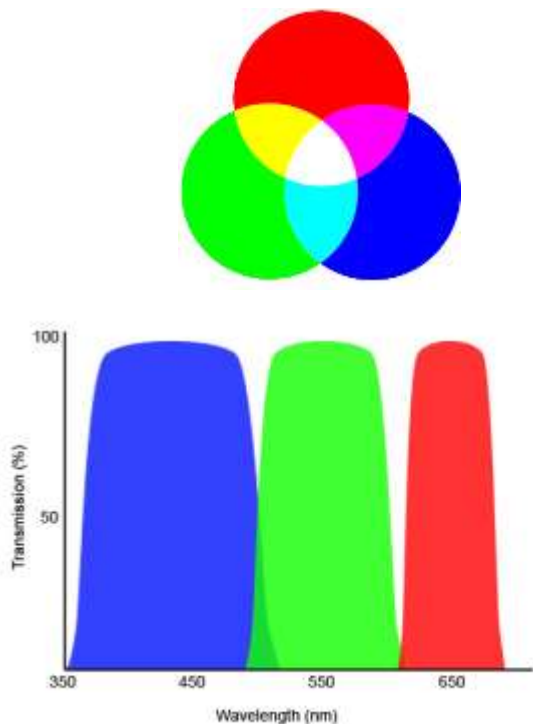
Type of Light Source

- ▶ Incandescent bulb
 - ▶ First industrial light source
 - ▶ 5% light, 95% heat
 - ▶ Few thousand hours of life
- ▶ Fluorescent lamp
 - ▶ White light
 - ▶ 25% light
 - ▶ 10,000s hours
- ▶ Solid-state light emitting diode (LED)
 - ▶ Compact
 - ▶ 50% light
 - ▶ More than 50,000 hours lifespan



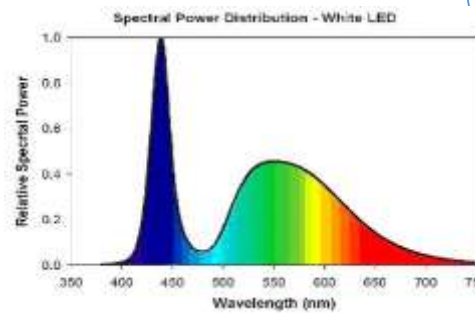
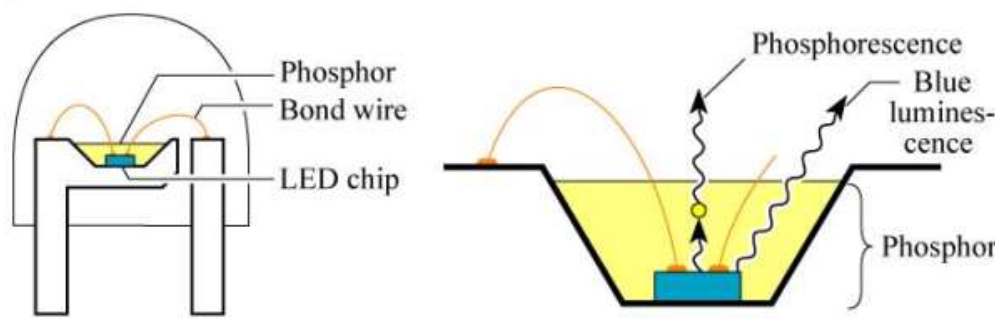
White Light LED

RGB LED



Well-known technology, limited use,
problem with balancing each R, G, B
component to create white light

Blue LED + Phosphor



Popular for today general lighting,
efficient and cheap

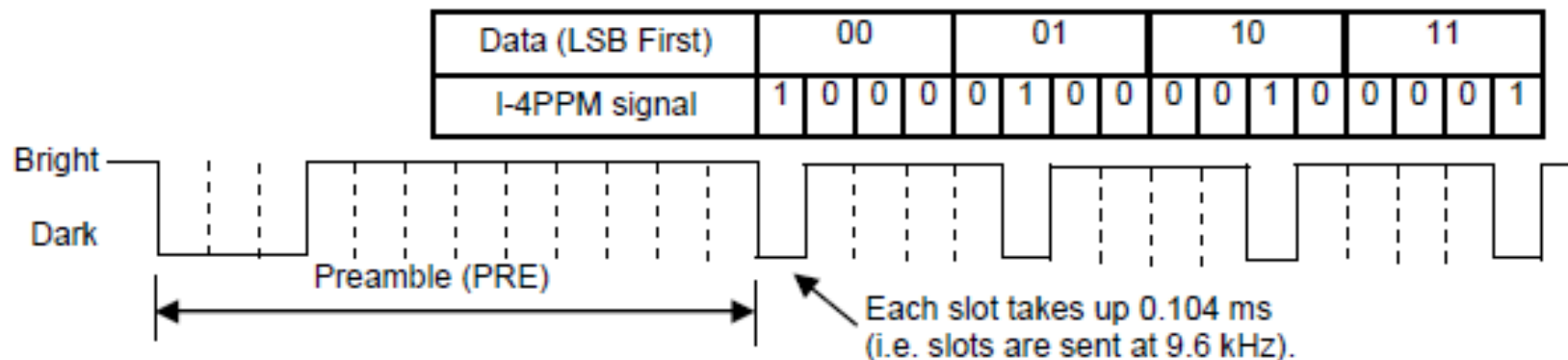
Source: Hoa Le Minh and Zabih Ghassemlooy, Visible Light Communications, Optical Communications Research Group (OCRG), Northumbria University.

CP1223 standard

- ▶ One of the most popular VLC standard announced by “Standard of Japan Electronics and Information Technology Industries Association”.

Data rate: 4.8[Kb/s]

Method of transmission: I-4PPM (inverted 4-slot pulse-position modulation)



Frame configuration:

SOF (Start of Frame)		Payload	EOF (End of Frame)
PRE (6 bits)	F-TYPE (8 bits)	ID/DATA (128 bits)	CRC-16 (16 bits)

Receiver

- Generally used Photodiode as a signal receiving device

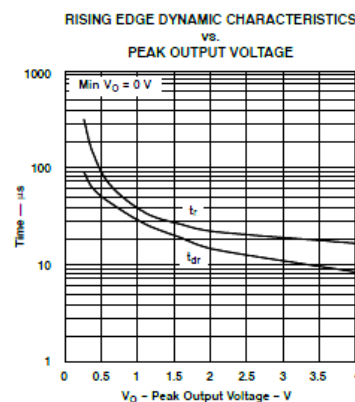
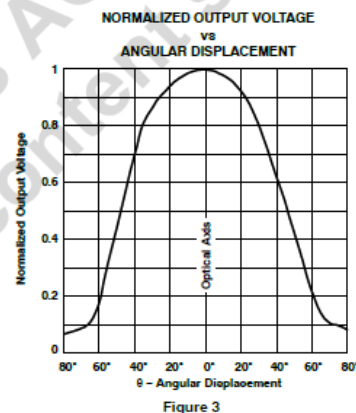
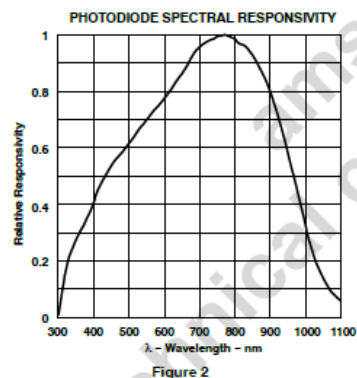
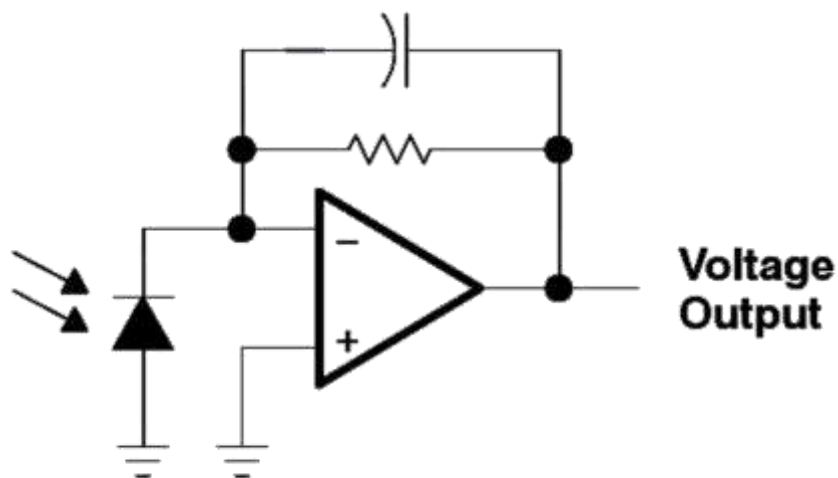


Figure 4

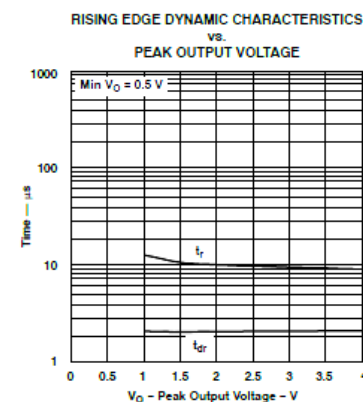


Figure 5

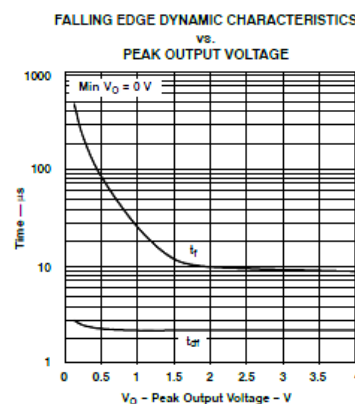


Figure 6

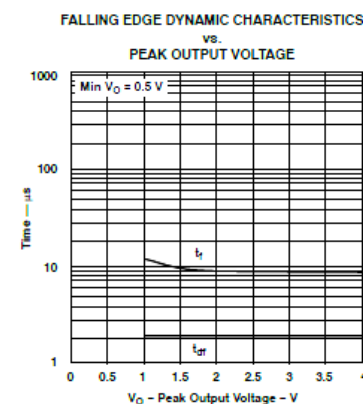
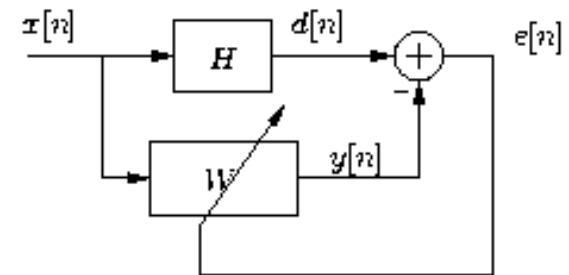


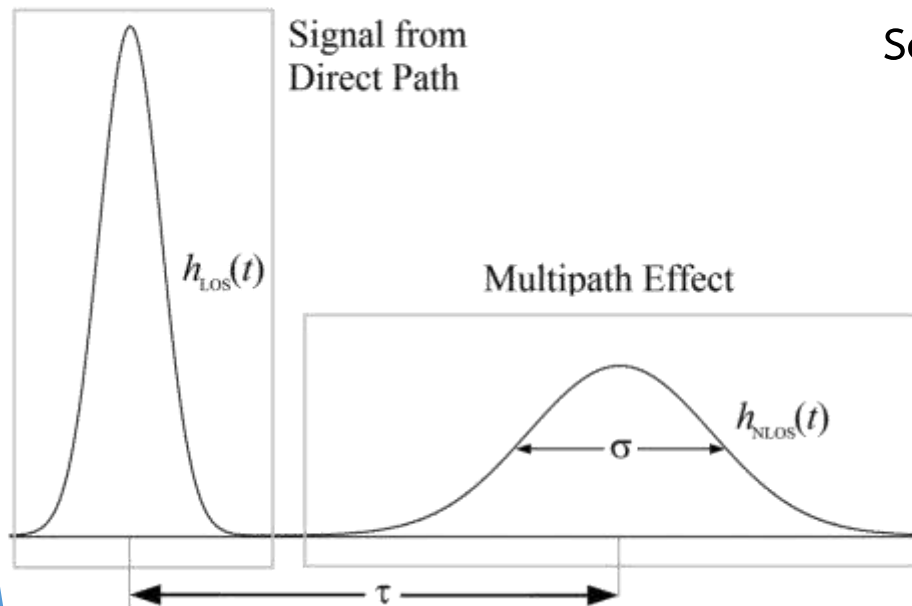
Figure 7

Signal Processing

- Optical and electrical filtering:
 - Block out-of-band background light
 - Remove electrical harmonics
- Equalization required:
 - Bandwidth limited by LED response and by multipath
 - Types of equalizers:
 - FIR filters, adapted using an LMS algorithm
 - Decision-feedback equalizer
 - MLSE – very complex
- Remove multiuser interference



Solution for shadowing



Solution for shadowing

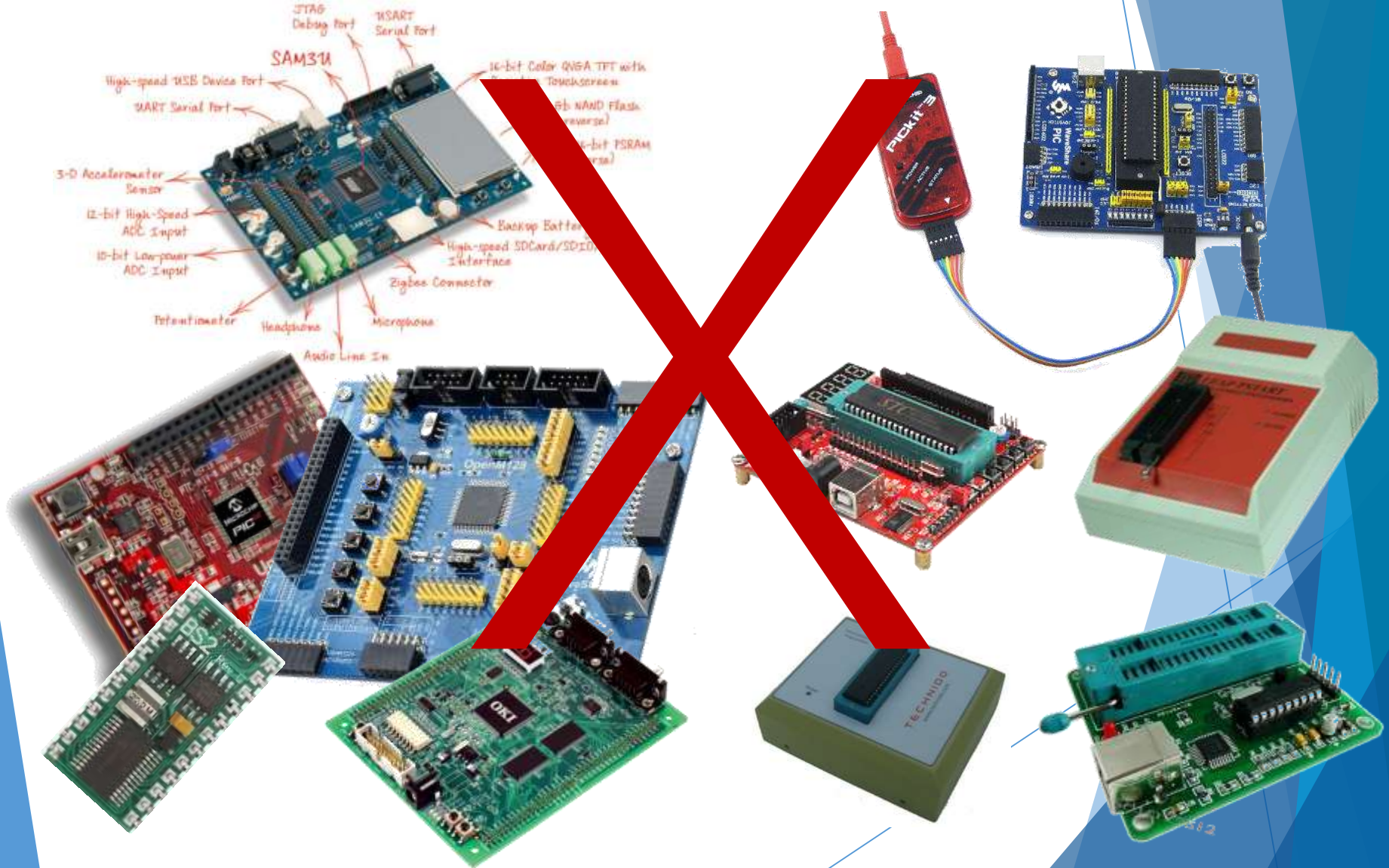
- As shown before, the impulse response in VLC systems has two parts
- When the line-of-sight (LOS) part (which is received via direct path) is blocked, the impulse response is only the second part
- Then the data can be recovered using the second part which is indeed the received data from the indirect paths (multipath signal)

Microcontroller Families & Manufacturers

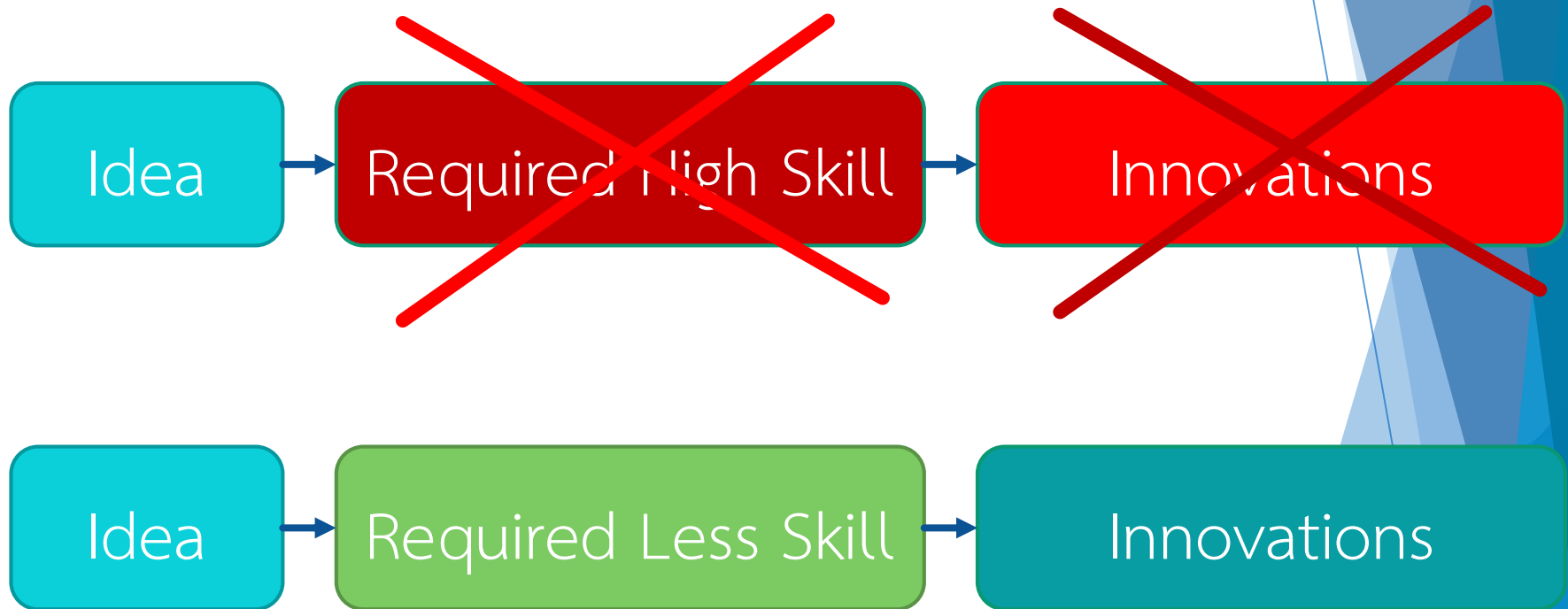
- ▶ 8051: (multiple manufacturers)
- ▶ Atmel: AT and AVR
- ▶ Microchip: PIC
- ▶ ARM: (multiple manufacturers)
- ▶ Cypress Semiconductor: PSoc
- ▶ Intel
- ▶ Parallax: Basic stamp
- ▶ etc.



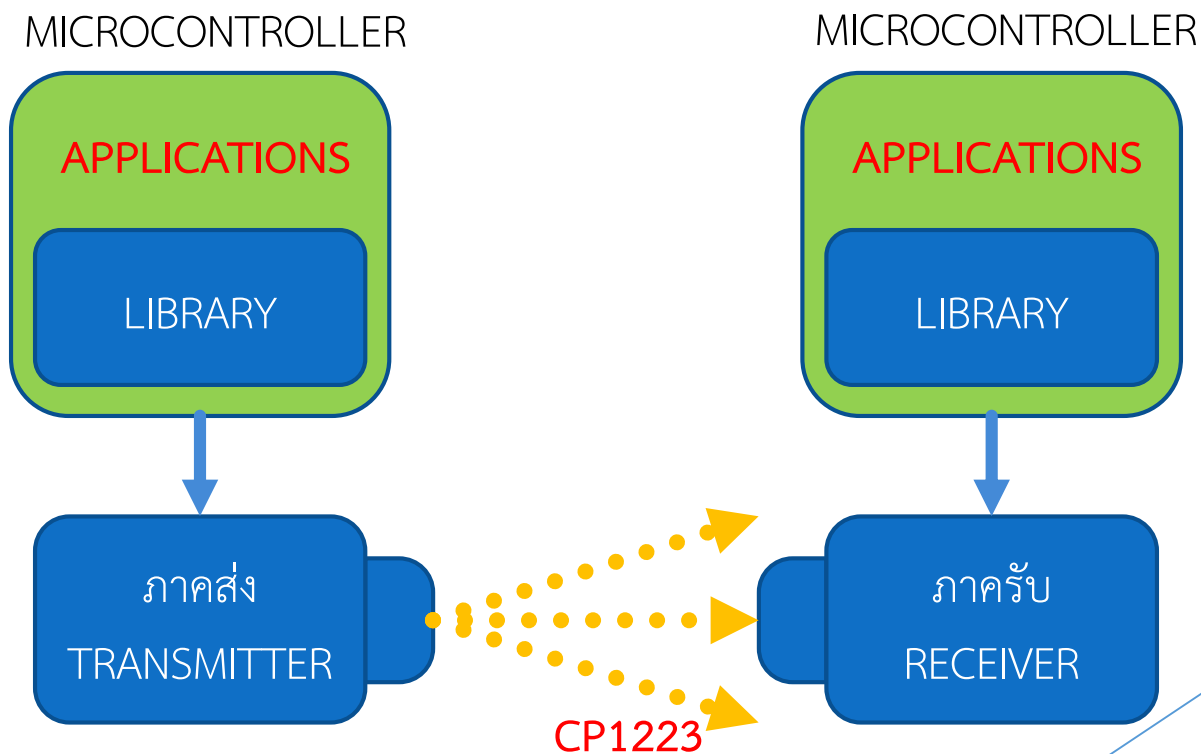
Various versions of Board, Programmer and Programming Language



ที่มาของการพัฒนาชุดพัฒนาอุปกรณ์สื่อสารข้อมูลผ่าน
แสงส่องสว่างที่สามารถเข้าใจและพัฒนาได้ง่าย



องค์ประกอบของชุดพัฒนาอุปกรณ์สื่อสารข้อมูลผ่านแสงสว่าง



Arduino?

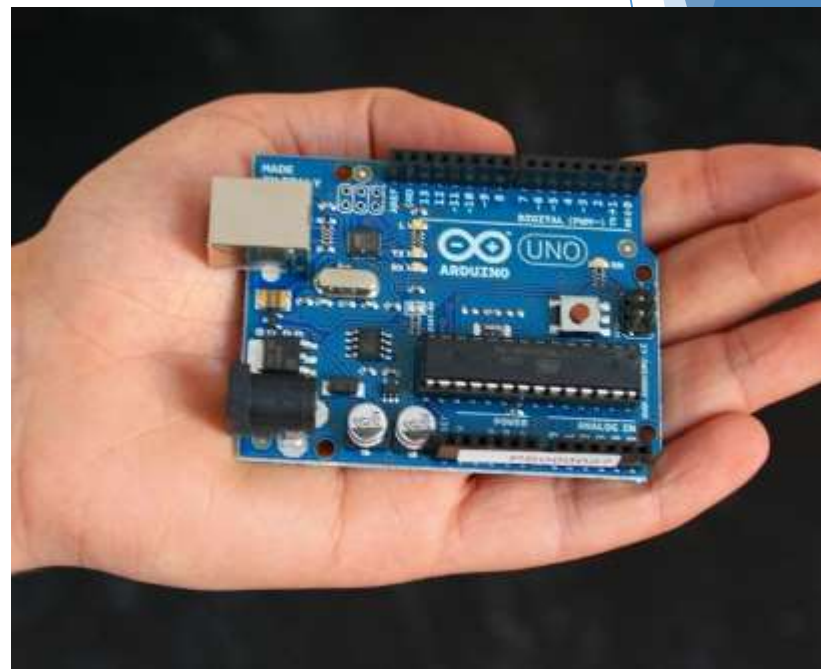


- ▶ *“Arduino is an open-source electronics prototyping platform based on flexible, easy-to-use hardware and software. It's intended for artists, designers, hobbyists, and anyone interested in creating interactive objects or environments.” (www.arduino.cc)*

What is Arduino Not?

- ▶ It is not a chip (IC)
- ▶ It is not a board (PCB)
- ▶ It is not a company or a manufacturer
- ▶ It is not a programming language
- ▶ It is not a computer architecture

(But it is involves to all these)



History

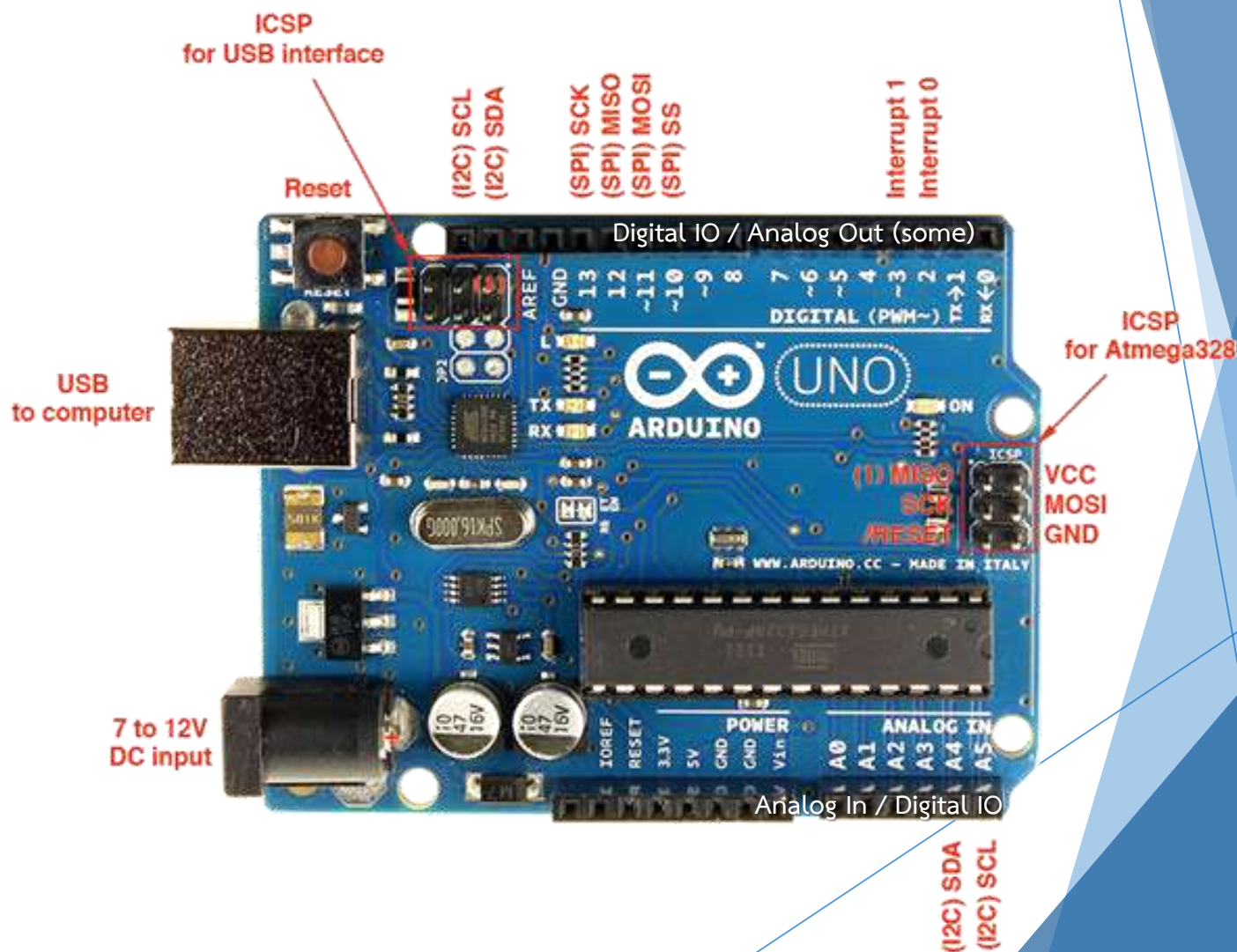
“Arduino is more than a business, it's a worldwide movement dedicated to education, electronics, programming, making... for everyone.”



- ▶ Founded by **Massimo Banzi** and **David Cuartielles** in 2005
- ▶ Based on “Wiring Platform”, which dates to 2003

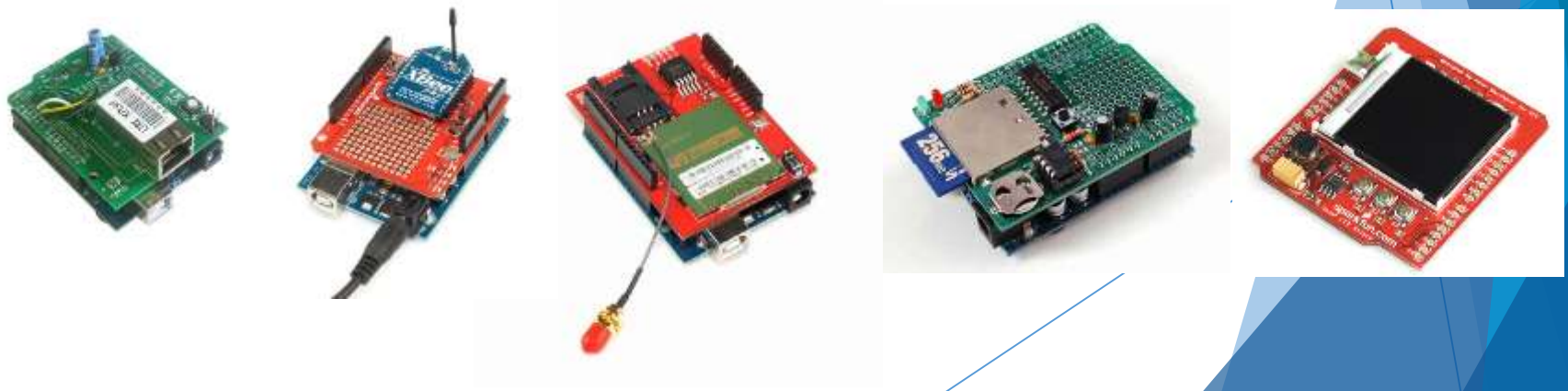
Arduino UNO I/O

► <http://arduino.cc/en/Main/arduinoBoardUno>



Arduino Shield & Module

- TFT Touch Screen
- Data logger
- Motor/Servo shield
- Ethernet shield
- Audio wave shield
- Cellular/GSM shield
- WiFi shield
- Proto-shield
- ...many more





Open Source Arduino Project

► <http://www.instructables.com/id/Arduino-Projects/>

Arduino Projects by zacknrgy/
4. Rating Last update Jun 23 1,455,321 172

To make all of these Instructables, download this collection of How To's as an eBook.

The Arduino microcontroller has a nearly limitless array of innovative applications for everything from robotics and lighting to games and gardening! It's a fun way to automate everything, enabling you to control simple devices or manage complex Halloween displays.

The Instructables editors have chosen some of our best do-it-yourself Arduino technology projects to educate and inspire you to make great things with easily-available tools.



Intro to Arduino by reindorff



The Word Clock - Arduino version by shyt11



LED Cube 8x8x8 by chr



turn signal biking jacket by reindorff



Twitter Enabled Coffee Pot by reindorff



Arduino-Controlled Robotic Drum by reindorff



Electronic Instrument by reindorff



How to hack EEG toys with arduino by reindorff



Arduino Wireless Animatronic Hand by reindorff



Open Source Arduino Project

► <http://makezine.com/category/arduino/>



The screenshot shows the "Make:" website's Arduino category page. The header includes the "Make:" logo and navigation links for Electronics, Workshop, Craft, Science, Home, and Art & Design. A red "SUBSCRIBE TODAY!" button is visible. Below the header, a red banner reads "Find all your DIY electronics in the Maker Shed → 3D Printing, Kits, Arduino, Raspberry Pi, Books & more!" with a "SHOP NOW" button. The main section is titled "Arduino" with the subtitle "The little microcontroller that launched a maker revolution." Below this, there are two main featured project sections. The first, "FEATURED IN ARDUINO", includes "PROJECT" cards for "S.M.A.R.T. Alarm Clock" (combining Arduino Yún with a TFT Touch Shield) and "Aluminalis: Our 16-legged Walking Creature" (with a quote: "Let's build something creepy, Dad...", my teenage daughters said. We had no idea this creepy..."). To the right of these is a "Maker Faire" poster for Sept 20+21 at the New York Hall of Science, featuring a red robot and a "BUY TICKETS TODAY" button. The second section, "NEW IN ARDUINO", shows a grid of project images, including a colorful LED display, a woman's face, and a circuit board.

Make: Electronics Workshop Craft Science Home Art & Design

Maker Shed Store Projects Blog Videos Maker Faire Events Education Maker Pro Contribute Books Magazine

Find all your DIY electronics in the Maker Shed → 3D Printing, Kits, Arduino, Raspberry Pi, Books & more! SHOP NOW

Arduino

The little microcontroller that launched a maker revolution.

FEATURED IN ARDUINO

PROJECT

S.M.A.R.T. Alarm Clock
Combine the Arduino Yún with a TFT Touch Shield to assemble a homemade alarm clock...

Aluminalis: Our 16-legged Walking Creature
"Let's build something creepy, Dad...", my teenage daughters said. We had no idea this creepy...

Maker Faire
SEPT 20+21
NEW YORK HALL OF SCIENCE
BUY TICKETS TODAY

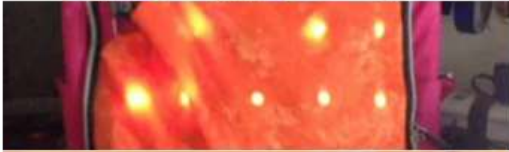
NEW IN ARDUINO



Open Source Arduino Project

► <http://www.adafruit.com>

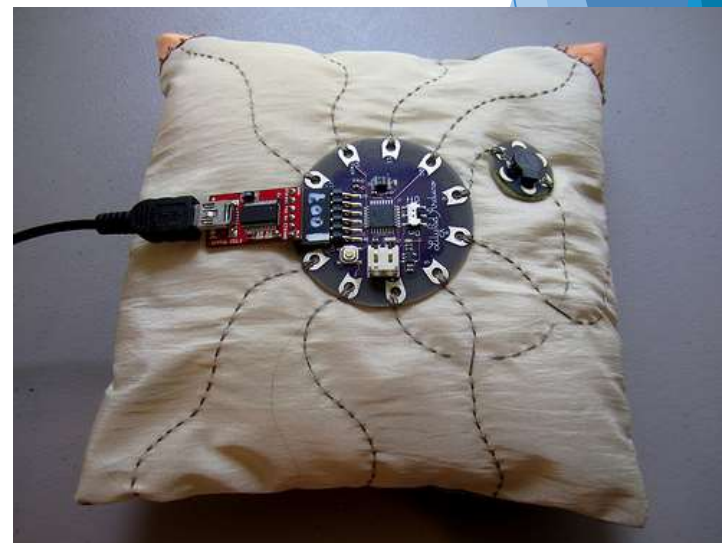
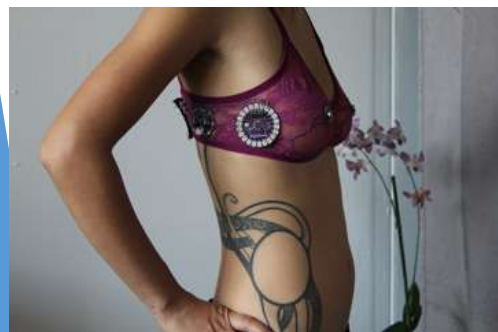
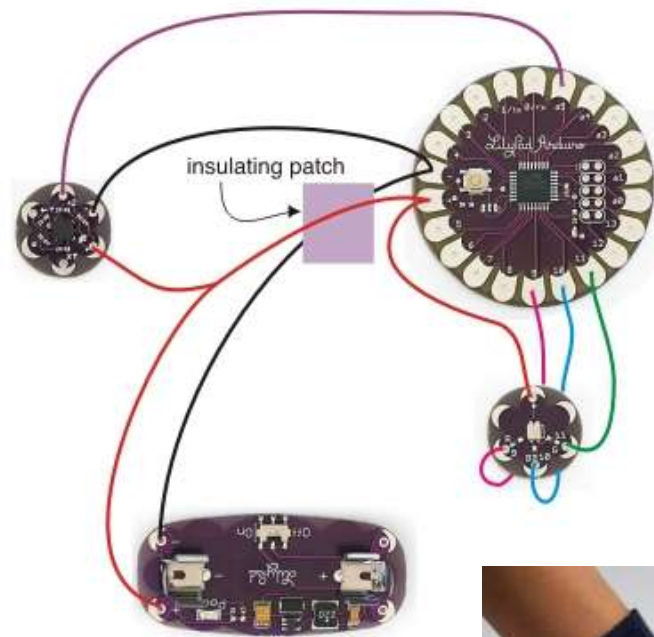


	800pin SD-1 Raspberry Pi @polargrah/drewbot Monday #rasberrypi @Rasberry_Pi — BY JESSICA
	JULY 2, 2014 AT 4:00 PM Kitt Sensors for Household Objects #WearableWednesday — BY BECKY STERN
	JULY 2, 2014 AT 2:00 PM DIY Data Gloves #WearableWednesday — BY BECKY STERN
	JULY 2, 2014 AT 7:00 AM Jeff's EDC Pinwheel Sneakers #WearableWednesday — BY BECKY STERN
	JULY 2, 2014 AT 3:00 AM A Blinkastic LED Matrix Backpack #WearableWednesday — BY LEZLIE BIRCH
	JULY 2, 2014 AT 2:00 AM LED Bunny Ears for a Wonderland #WearableWednesday — BY LEZLIE BIRCH
	JULY 1, 2014 AT 1:15 PM Promulgate — BY ADAFRUIT

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[Back to top](#)

Wearable Arduino (LilyPad)



Today, Microcontroller Technology

Arduino

ข้อความค้นหา

Microchip

ข้อความค้นหา

ATMEL

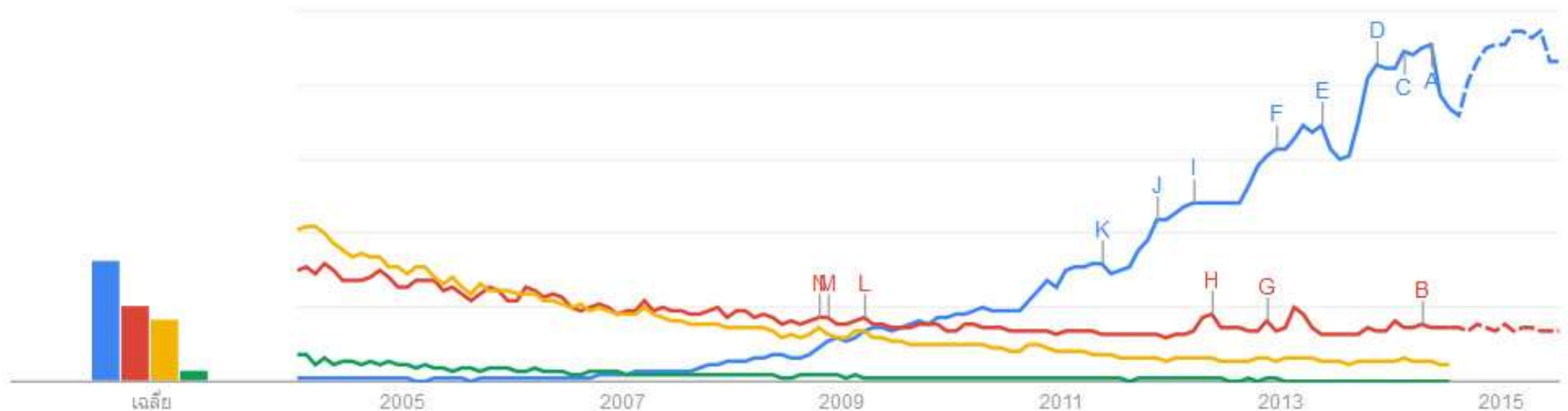
ข้อความค้นหา

Basic St...

ข้อความค้นหา

ระดับความสนใจตลอดเวลาที่ผ่านมา ?

☒ ข่าวเด่น ☒ คาดการณ์ ?

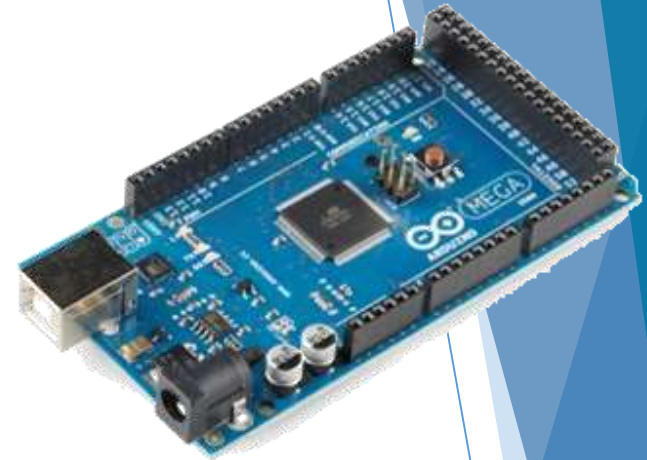


*ref: Google Trend

Arduino Boards



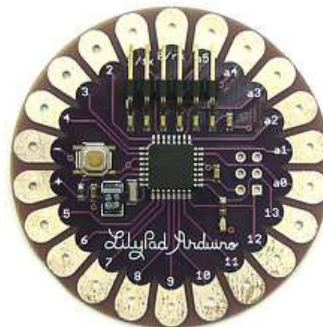
Arduino UNO



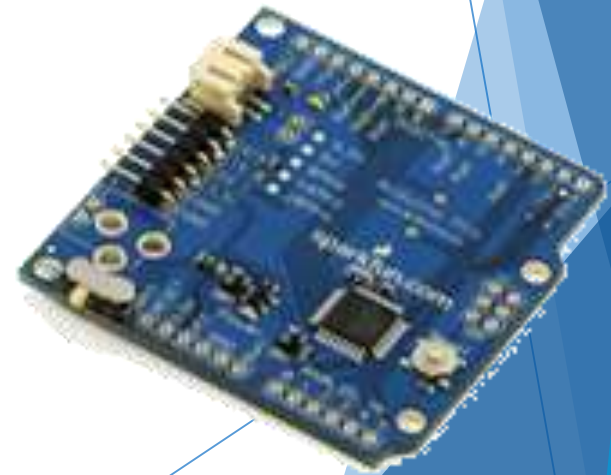
Arduino MEGA 2560



Arduino Pro mini



Arduino Lily Pad



Arduino Pro

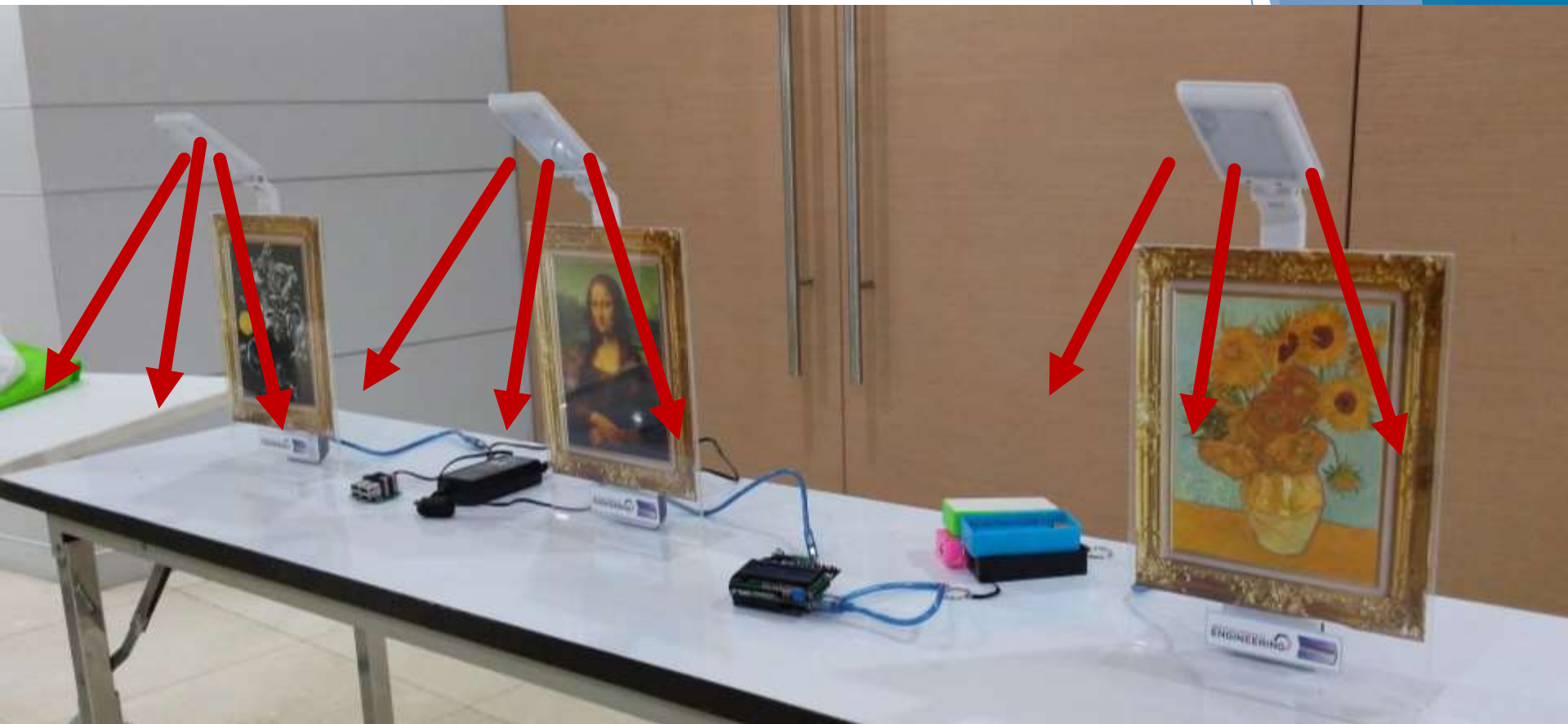
Arduino Pro Mini

- ▶ The Arduino Pro Mini is intended for semi-permanent installation in objects or exhibitions. The board comes without pre-mounted headers, allowing the use of various types of connectors or direct soldering of wires. The pin layout is compatible with the Arduino Mini.

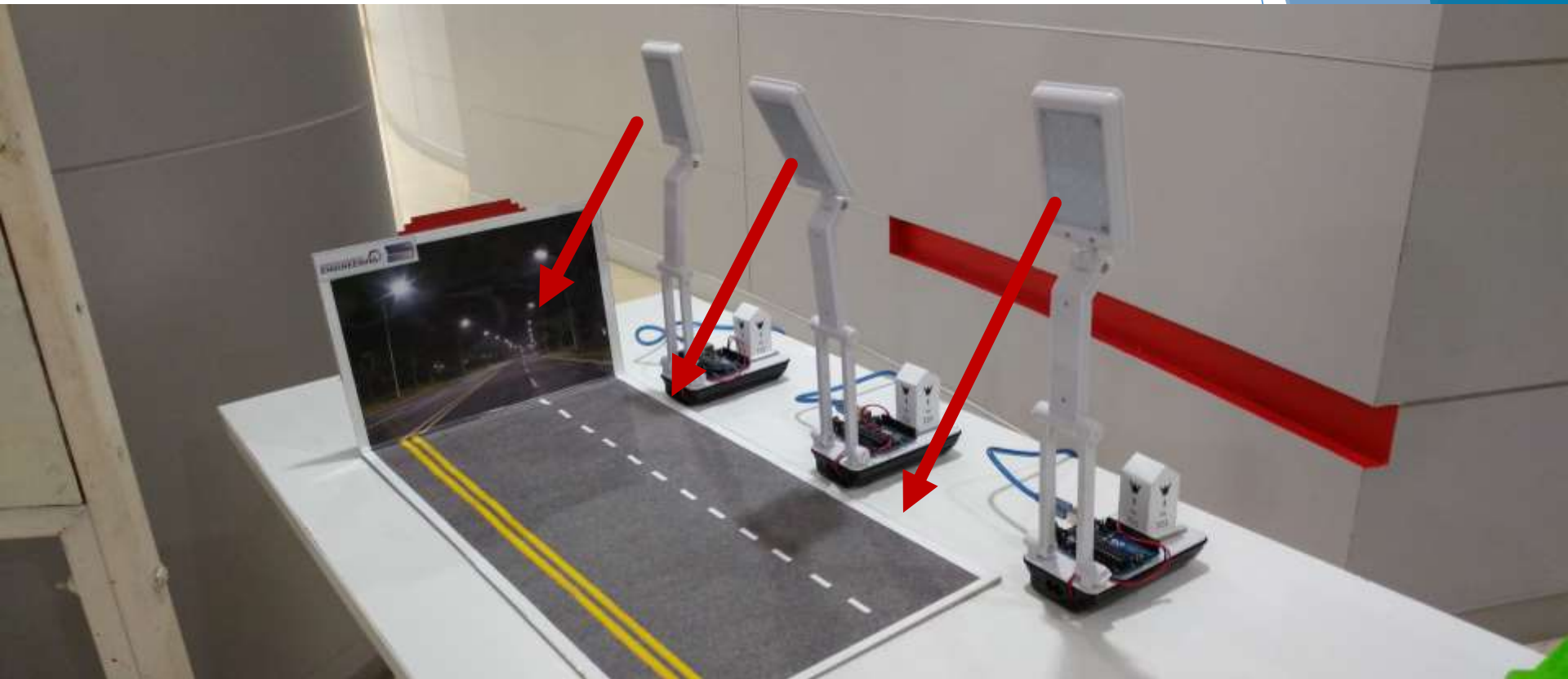


ตัวอย่างการใช้งานชุดพัฒนา อุปกรณ์สื่อสารข้อมูลผ่านแสงส่องสว่าง

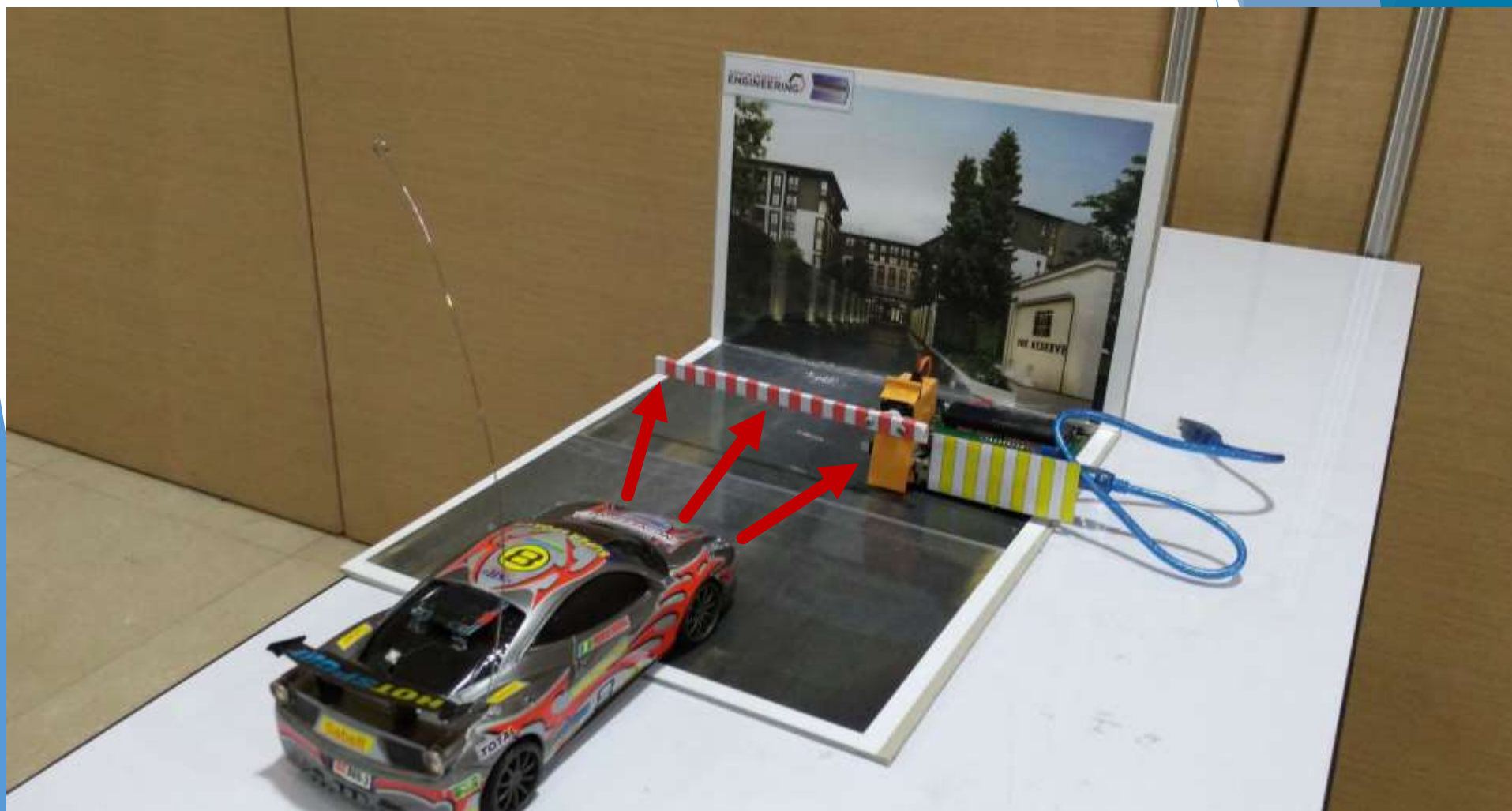
การสาธิต ระบบพิพิธภัณฑ์ดิจิทัล



การสาธิต ระบบบอกตำแหน่งจากไฟถนน



การสาธิต ระบบผ่านทางอัตโนมัติ



So, What is your VLC project

?

Q&A

Thanks you for your attention