LED軟性線路板及其應用
智慧照明與顯示器

國立中央大學 光電研究所

張榮森教授

張榮森實驗室
Rong Seng Laboratories

甚麼是智慧裝置？

- 可以偵測環境或是使用者的狀況，並且做出對應的改變。
- 例如：偵測到室內光線太暗，而調節室內照明的亮度；偵測到濃霧而改變光源光譜已達到穿霧效果的路燈。

智慧照明與智慧顯示器的兩大議題

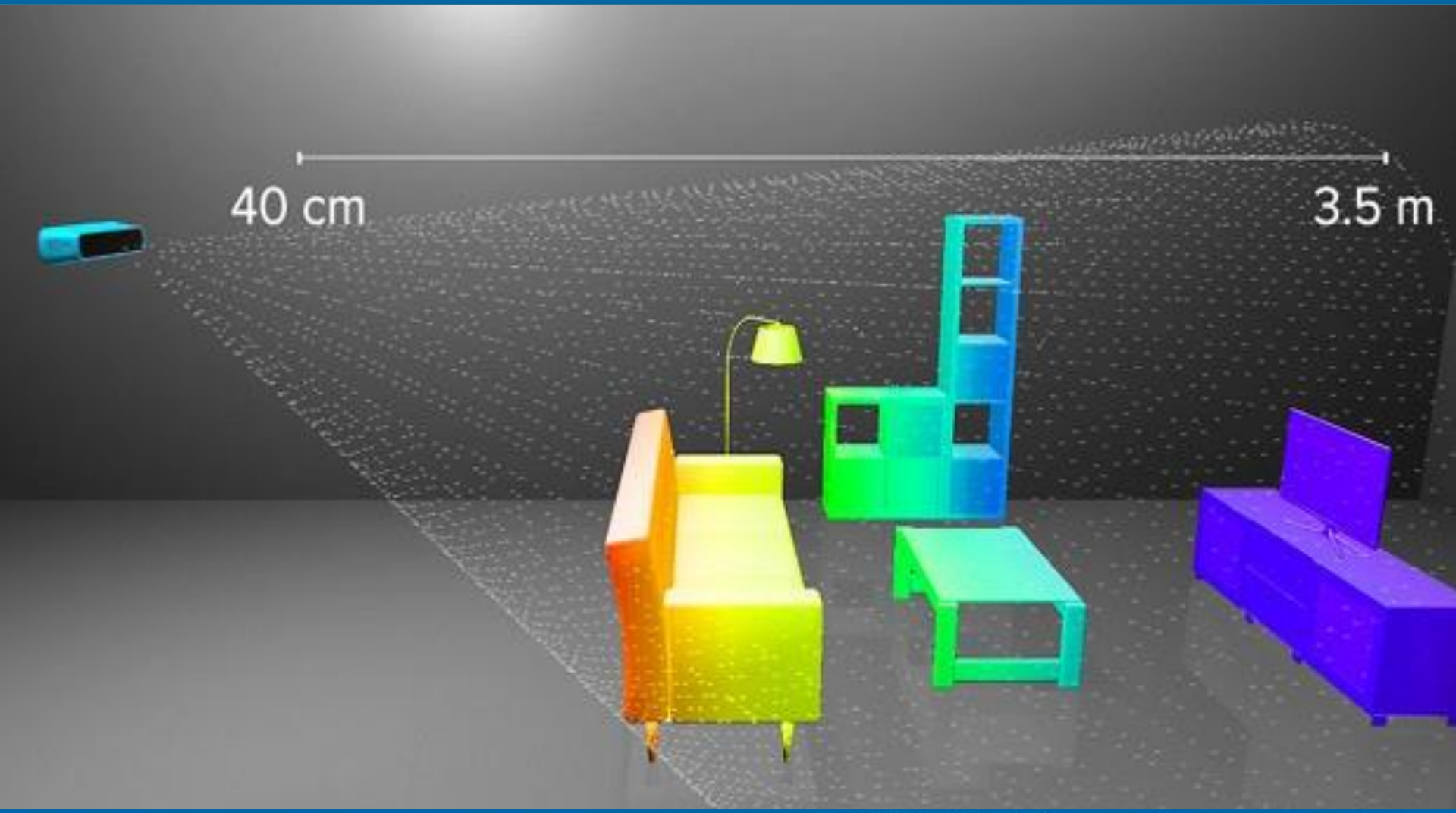
- How to interact with the environment?
- How to react and perform?

How to interact with the environment?

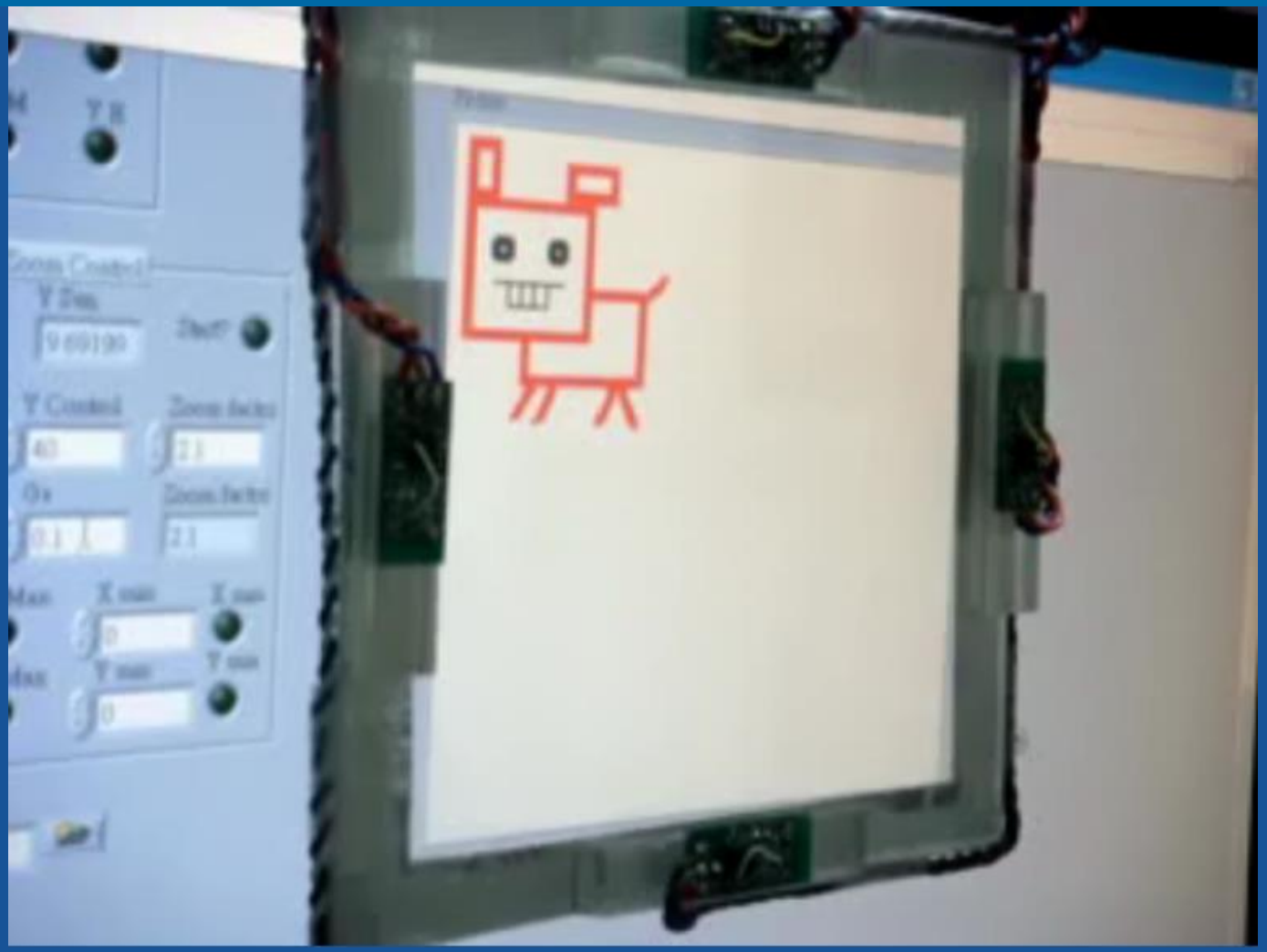
- 手動控制：透過使用者自身的自主意志來選擇所需要的效果。
- 自動控制：直接偵測環境的改變或是使用者身理訊號的改變，讓裝置作出反饋。

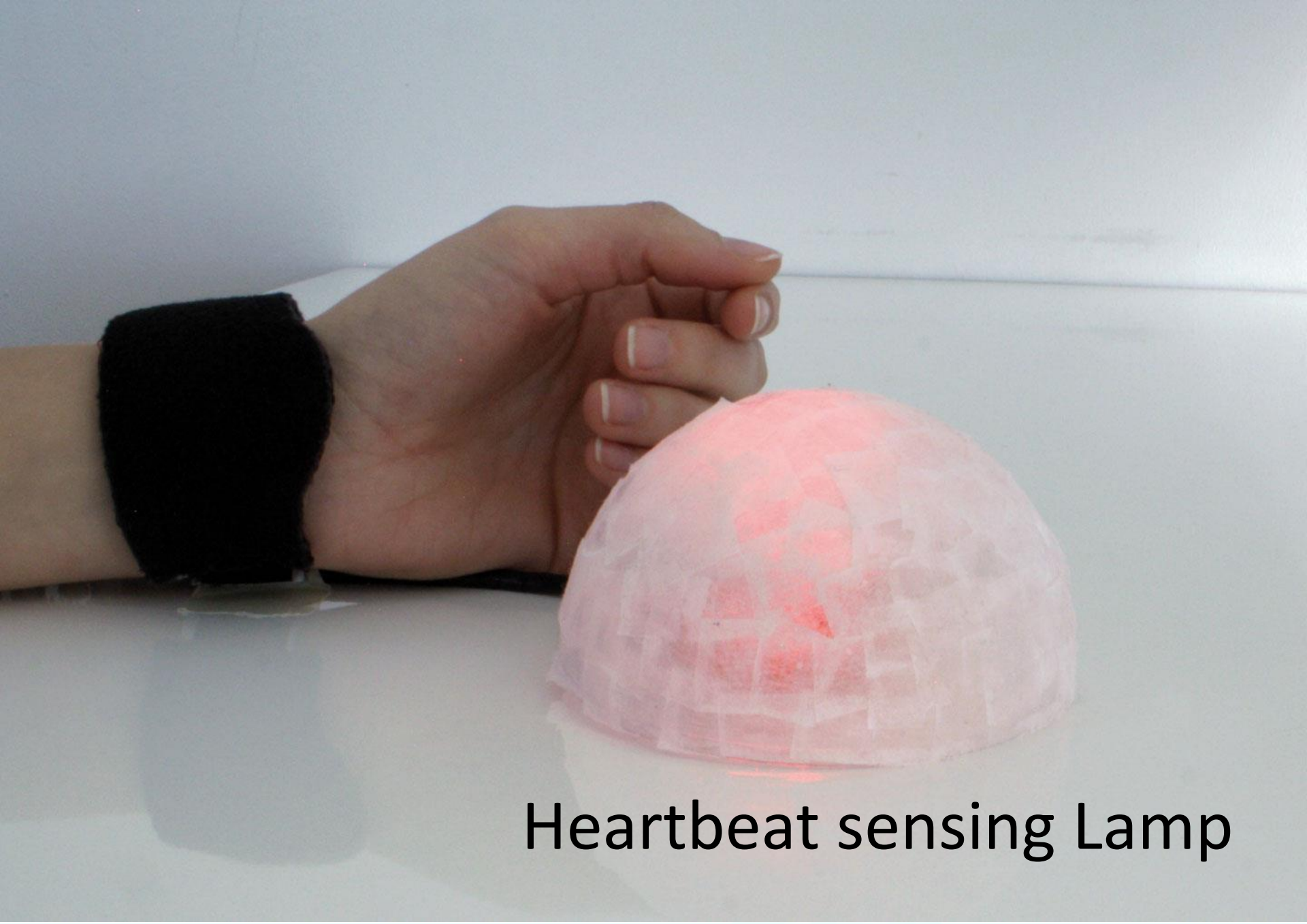
Wireless Control
by Smart phone or other device

手動控制： Depth Sensing



手動控制：雷達感應控制





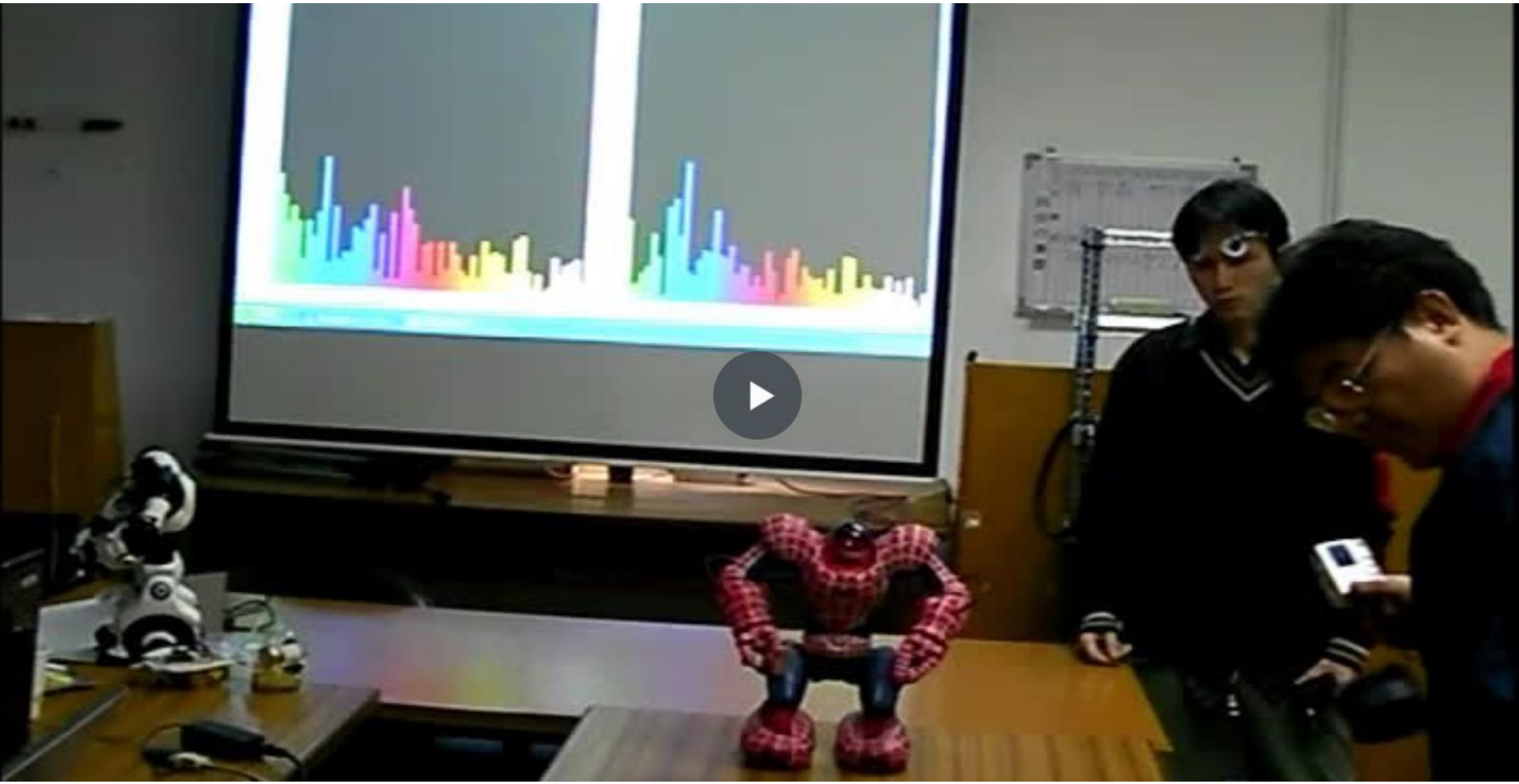
Heartbeat sensing Lamp

VOCCA

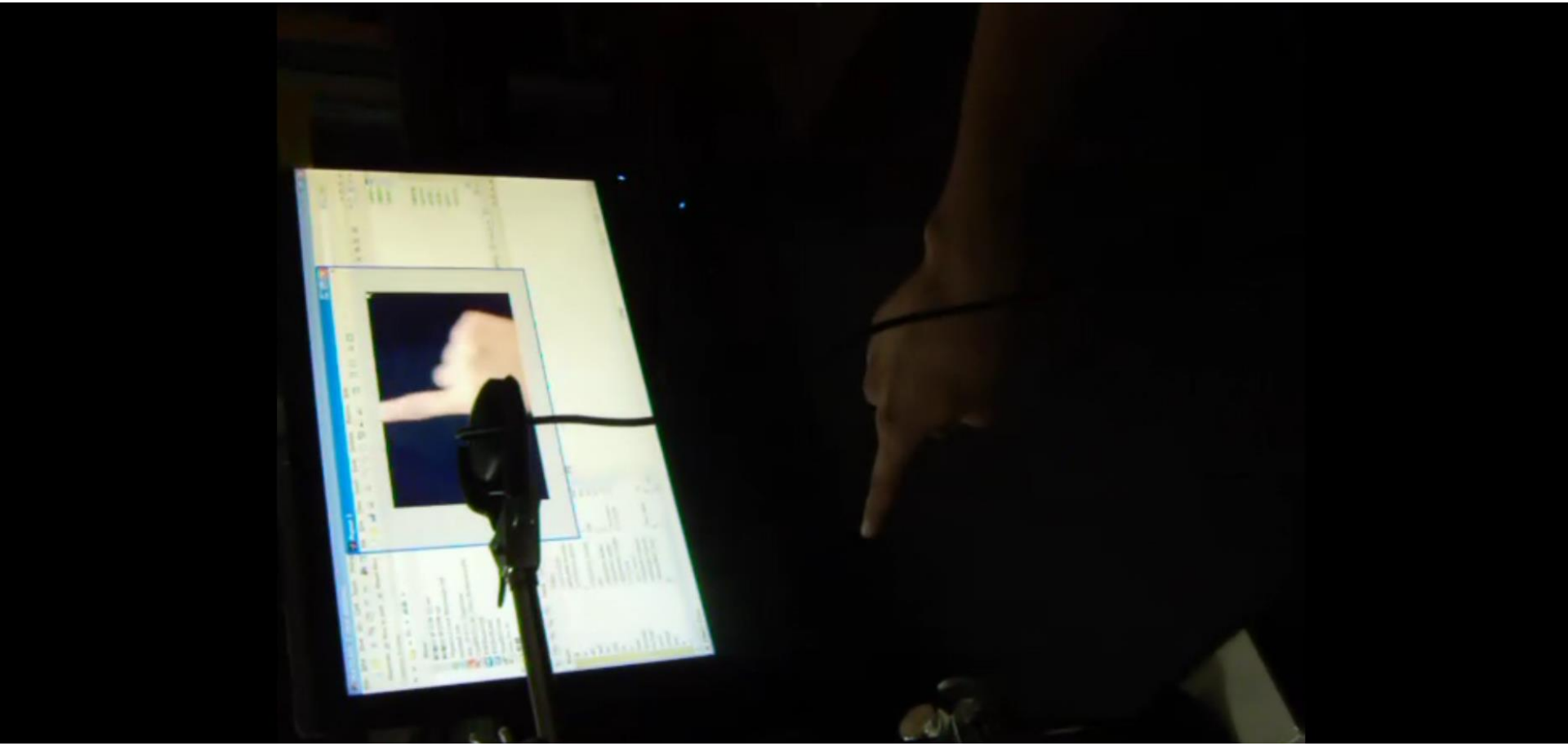
Our standard model allows users to simply screw any bulb into the VOCCA-adapter, connect the adapter into any light socket and say the magic words, "Go VOCCA Light".

Brainwave control Lamp

Brainwave control Robot

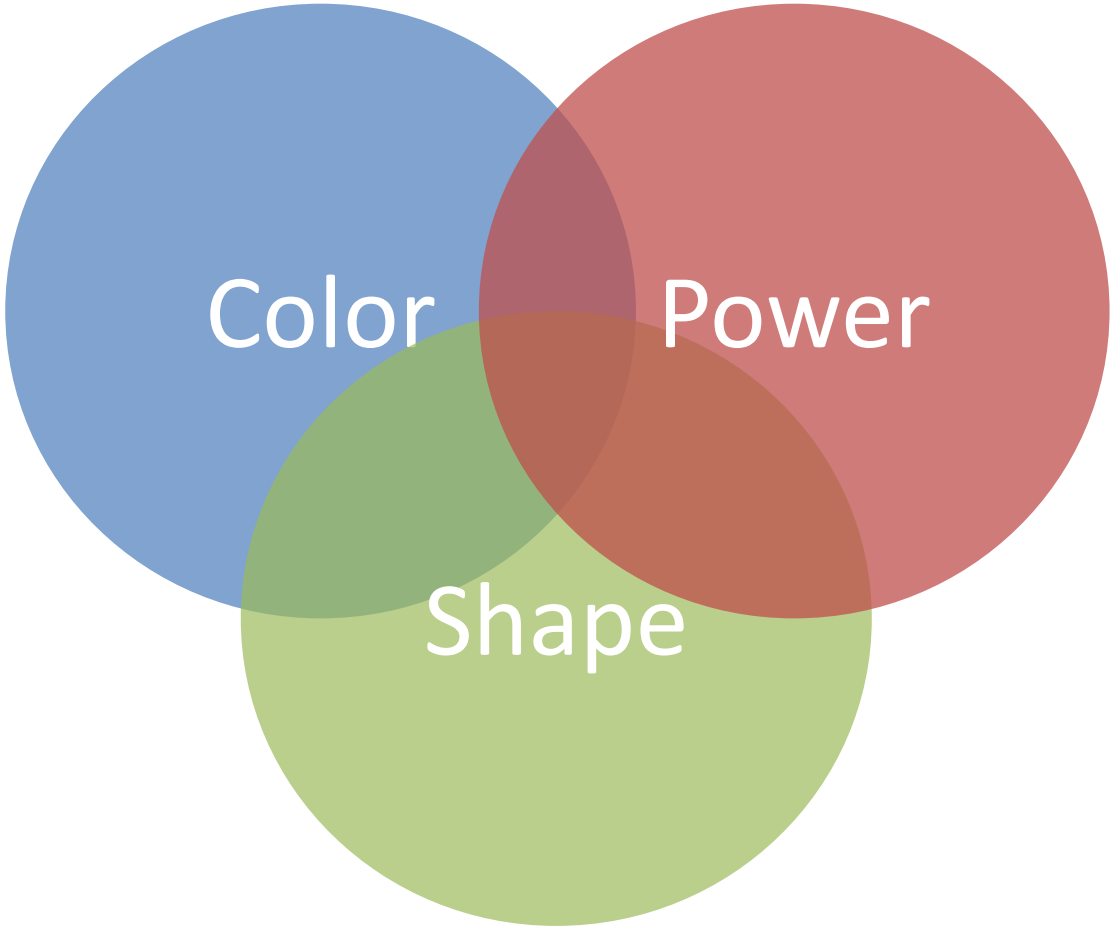


手勢控制



手勢控制

How to react and perform?

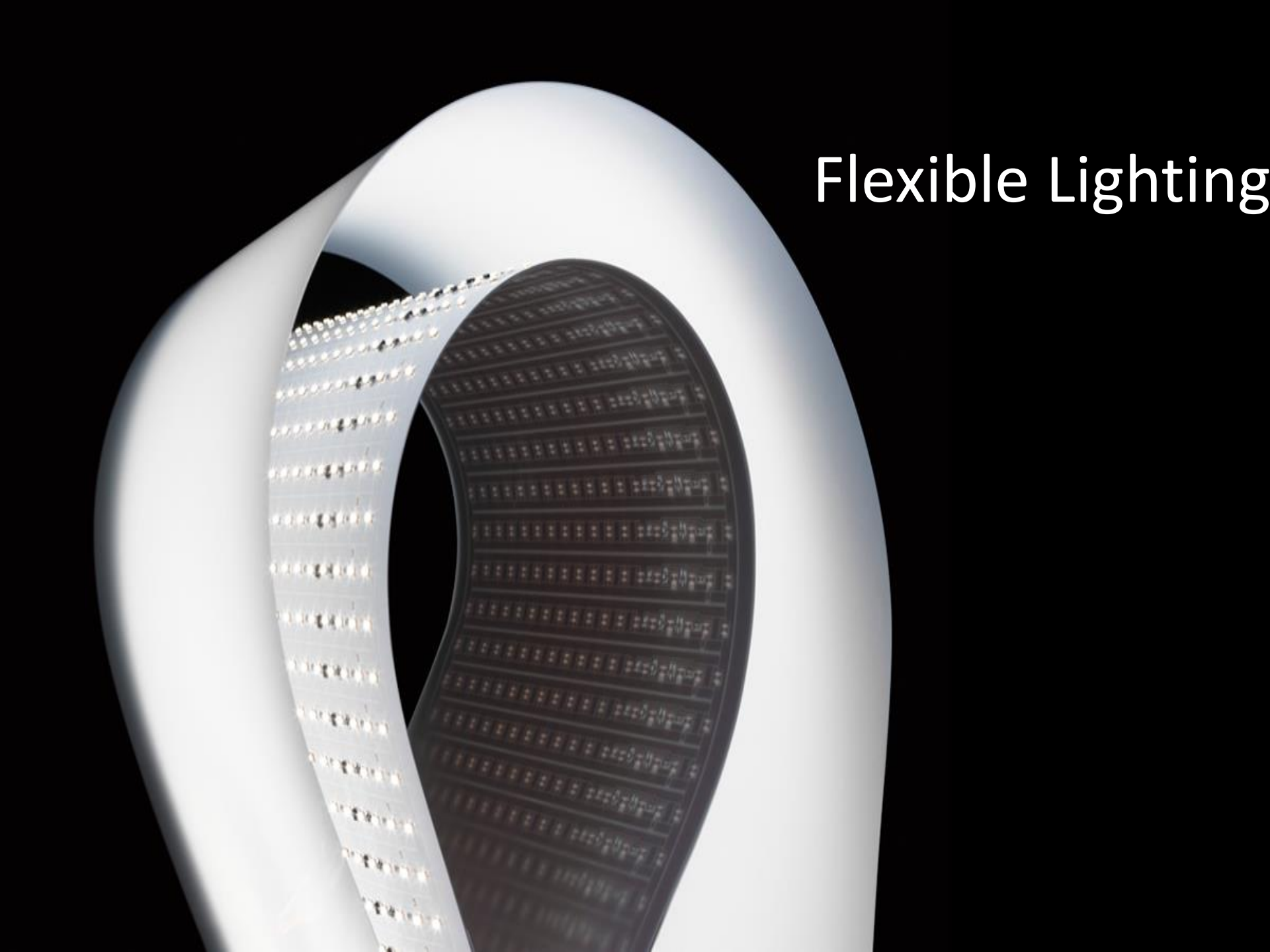


智慧照明


Hue
Cancel
Beach
Save
3. Dinner table
PHILIPS
PHILIPS
PHILIPS
PHILIPS

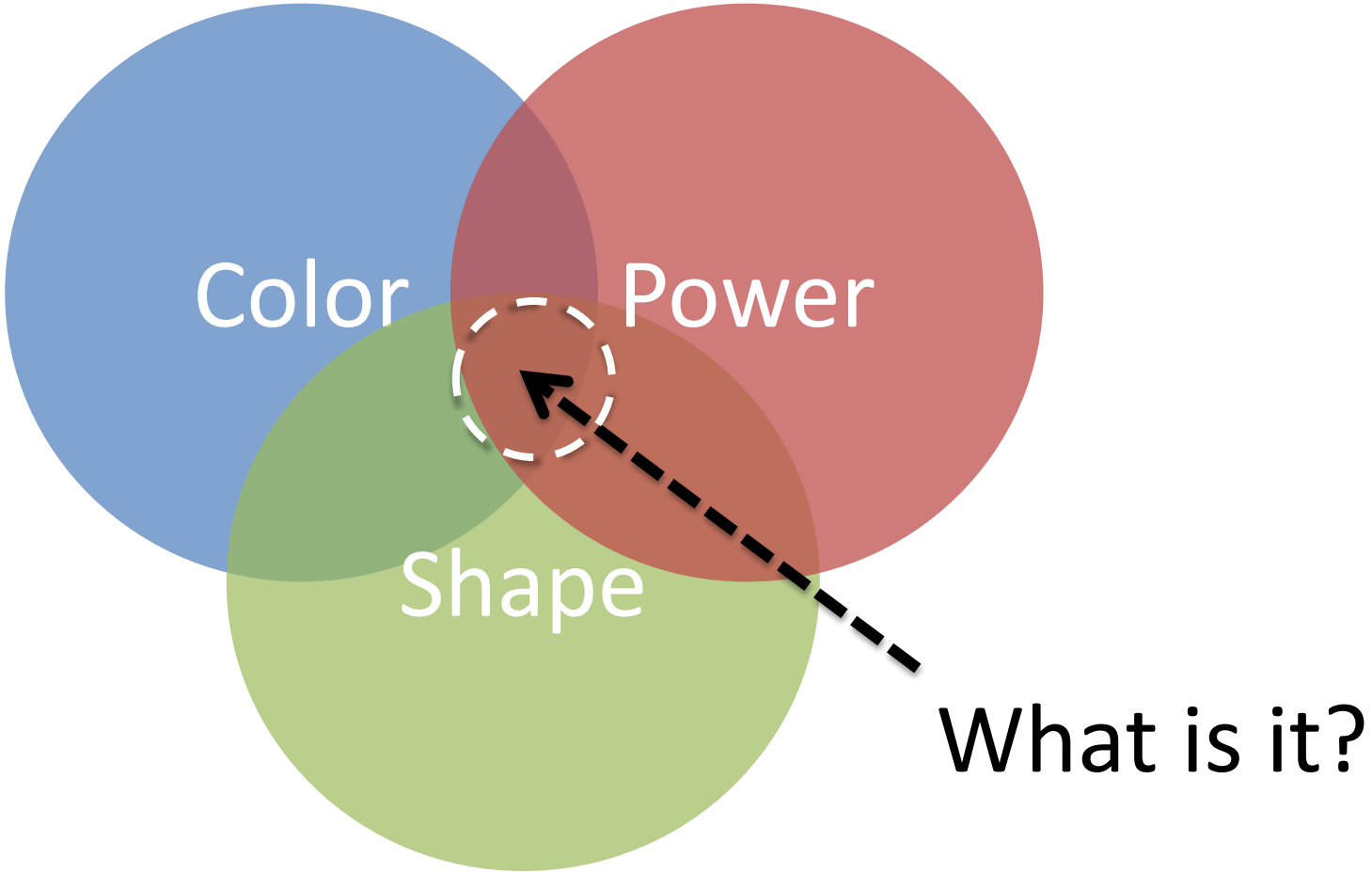
Philips: Hue


4:21 PM
Home
Living Room
Kitchen
Bedroom
Kids Bedroom
Rooms
Routines
More Hub


Flexible Lighting

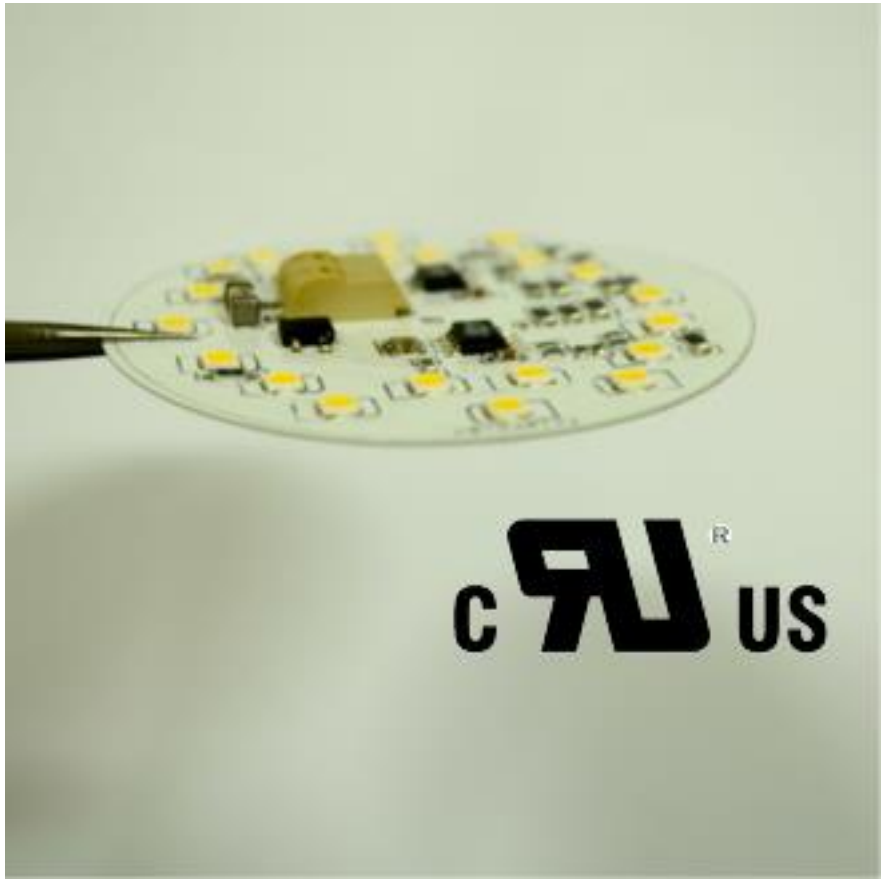
Powerful Heat Sink

How to react and perform?



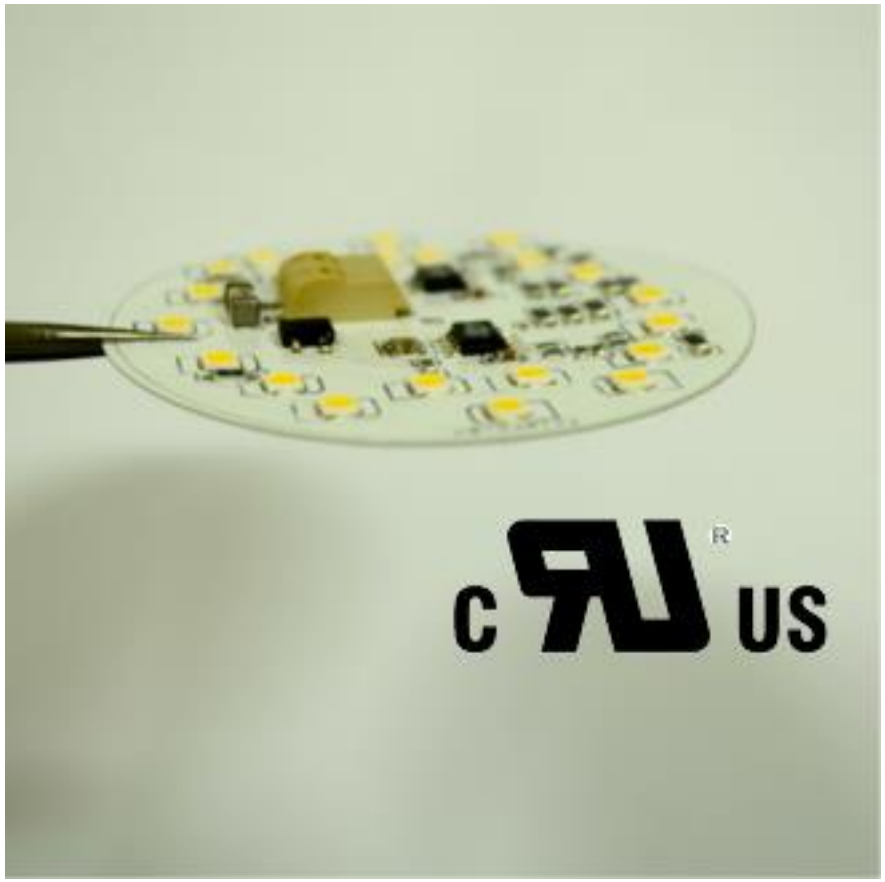
Our new technology:
Flexible Lighting using flexible ceramic PCB

Thermal Thin Film



- Thermal Thin Film is a flexible ceramic PCB technology developed by RS Labs.
- It has strong thermal effect, flexible ability, and quality for qualified PCB. Designers and engineers can put hot components, such as LEDs and ICs, on this thin and small flexible board without the break-down problem.
- It can be applied on LED lighting, wearable device, or any other flexible application.

Features



- Flexible
- Drop Temperature
- Insulation
- Ultra Thin
- Fire Retardant
- Multi Layer is possible

Flexible

- Thermal Thin Film can be scratched on any shape of surface. The flexibility is much better than FPC made by polymer.

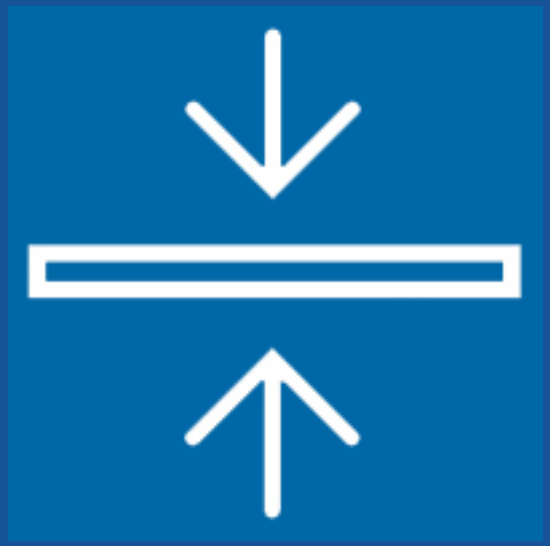
Drop Temperature

- You don't need to worry about the thermal problem anymore. With Thermal Thin Film, the temperature of components can be easily lower than 10 to 15%.
- The thermal conductivity is around 2.40 W/mK and the thermal resistance is lower than 0.307 ˚C/W.

Insulation

- Our Thermal Thin Film has been approved by UL for its insulation. The withstand voltage is over 4kV.
- It has been approved by UL.

Ultra Thin



- Total thickness of Thermal Thin Film is only 0.12 mm including based material, copper, and cover layer. It gives you more space for product design.

Fire Retardant

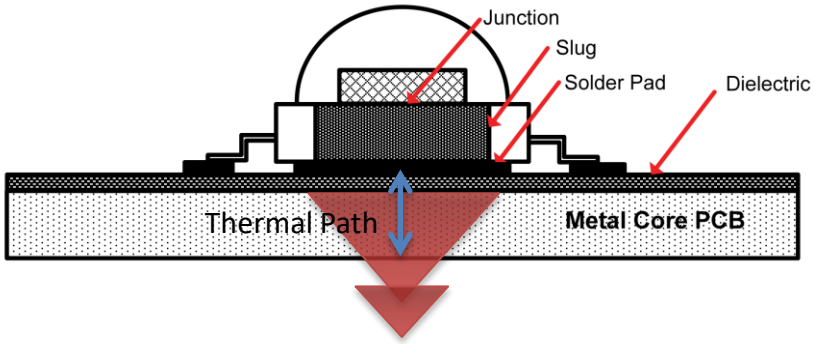
- The retardant point is 700 ˚C. The board can pass normal soldering temperature which is 270 ˚C during 10 seconds. Therefore, you can mount components on Thermal Thin Film using SMT and Reflow process.

Multi Layers

- Yes, multi layers is available for Thermal Thin Film. You can design your layout as multi layers PCB. For flexibility reason, we suggest the max number of layers is under 4.

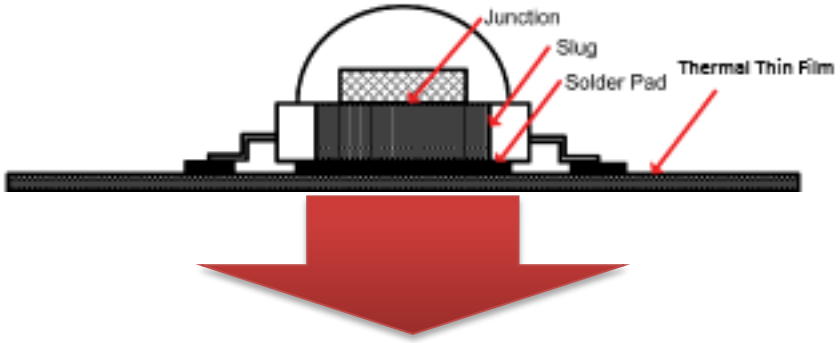
How does it work?

Traditional PCB: MCPCB



The thermal path of MCPCB is very long, about 1 to 2.5mm, which makes the heat stays in the component, such as LEDs. MCPCB has to be so thick to ensure that it is not deformed during installation – the deform of MCPCB will make some rooms between MCPCB and heat sink and block the thermal path.

Thermal Thin Film



The thermal path of Thermal Thin Film is only 0.12 to 0.15mm – almost 20 times less than MCPCB. Therefore, the heat will escape the component and PCB immediately to the heat sink. Since Thermal Thin Film is flexible PCB, which can be bonded on any kind of surface – no need to worry about the deform issue.

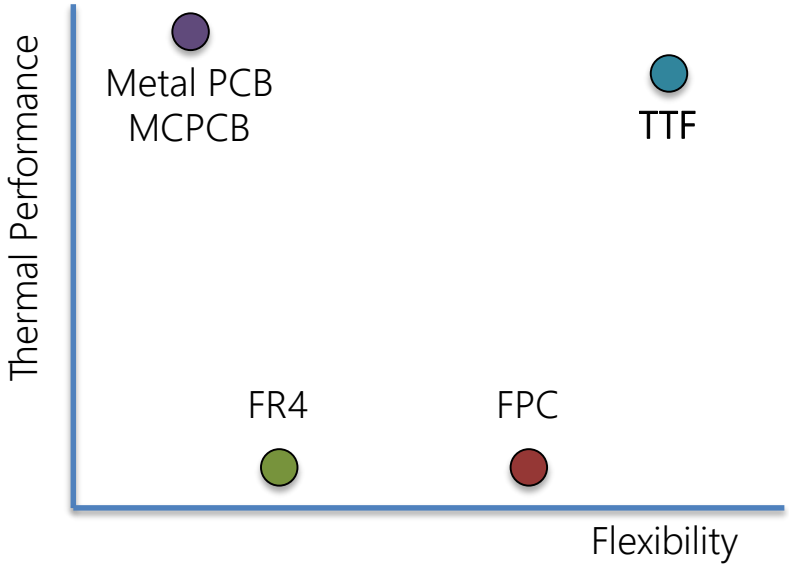
Low Thermal Resistance High Thermal Conductivity

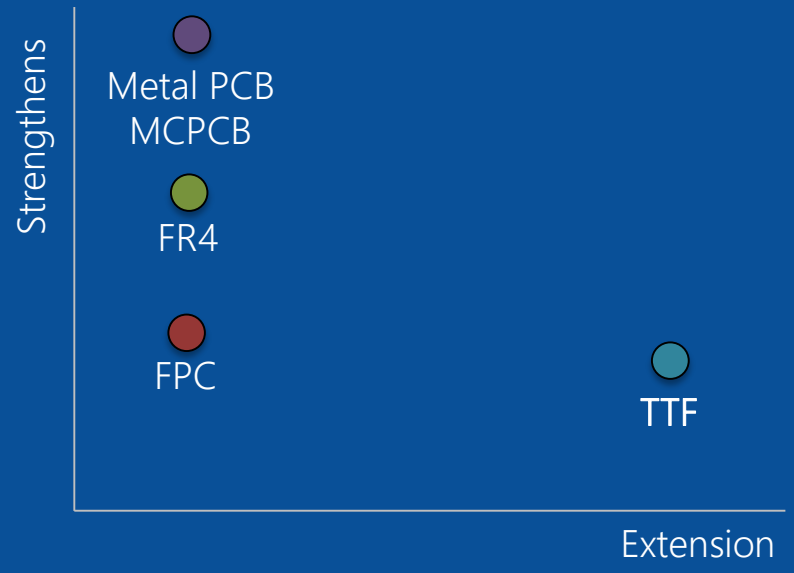
- Lower thermal resistance, faster heat transfer. Therefore, for thermal substrate, the lower thermal resistance is better.
- The thermal resistance of Thermal Thin Film is only 0.307˚C/W, which is the lowest one in current thermal substrate including MCPCB and FR4.

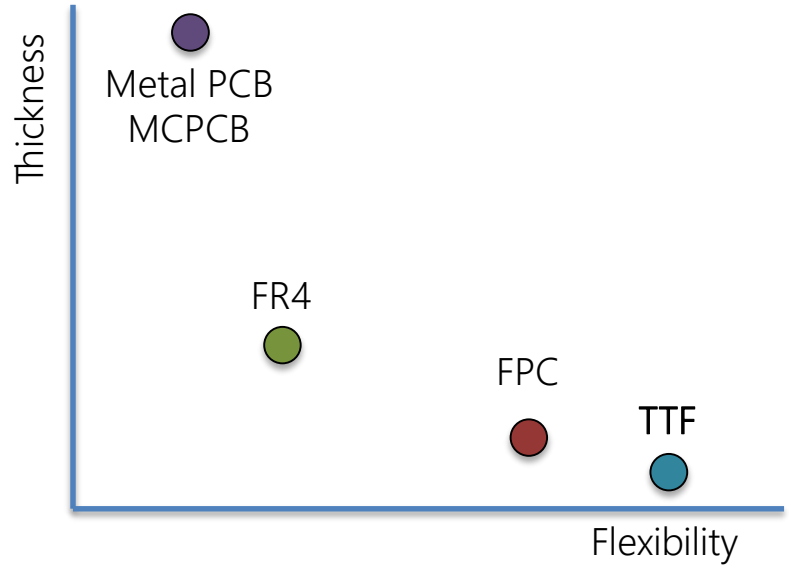
PCB sample	Thermal Resistance ˚C/W
MCPCB from one Chinese brand	0.92
N*K MCPCB	0.48
Nano coating MCPCB	0.54
MCPCB from one Taiwanese brand	0.49
Thermal Thin Film PCB	0.307

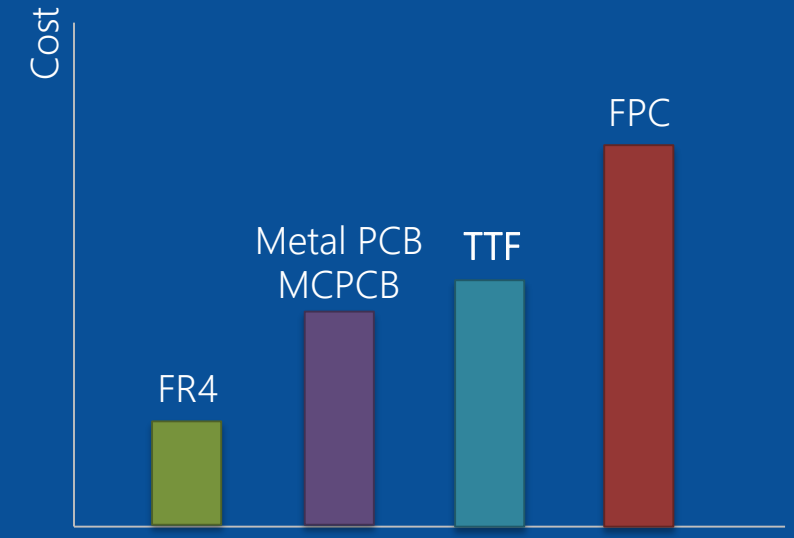
Report from NTHU Advance Cooling Lab

Competition Analysis







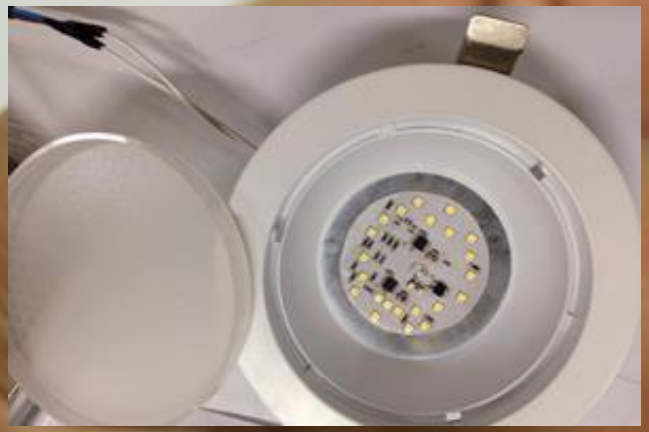


Thermal Radiant Effect

30W LEDs are put on an A4-size
Thermal Thin Film without any heat sink.

Flexible and Bendable

LED sticker on LED Down light



Integrating power IC and thermal thin film, we develop A LED sticker with 18W LEDs, which does not need an extra AC-DC adapter. Thermal Thin Film can keep the temperature of power IC Under 65˚C, which is the safe Working zone.

This LED sticker is easily for Assembly, and keep the life Long because of great thermal performance. And, the cost is also lower than current LED module because it has no AC-DC adapter.

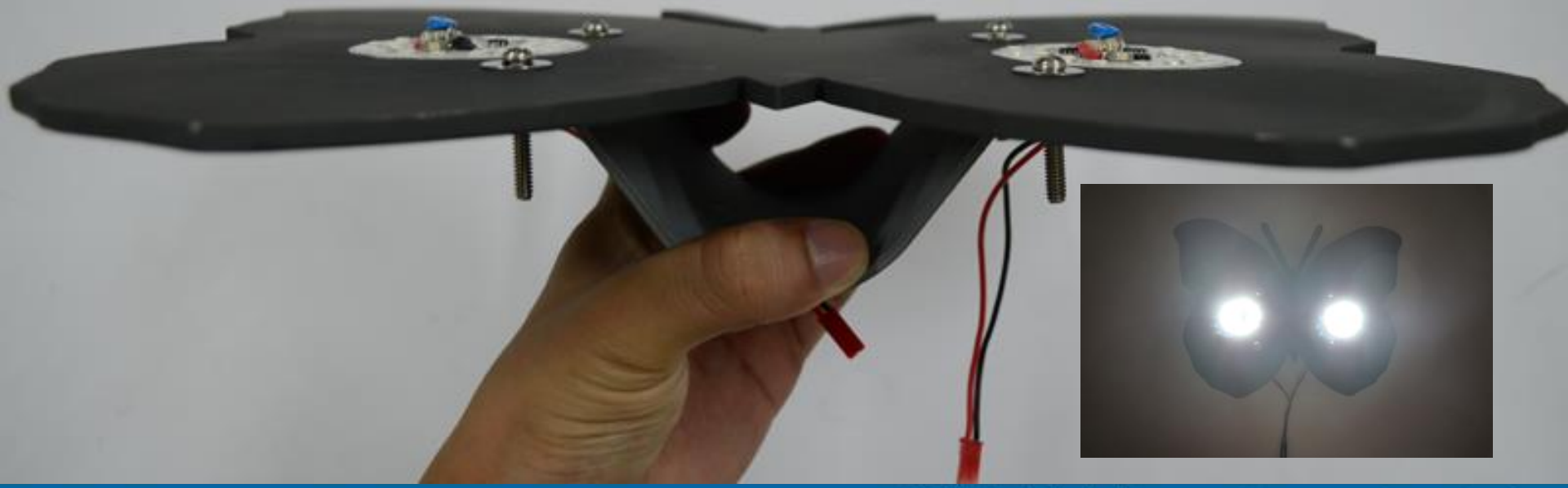
LED Sticker: Street Light Sticker

We paste a 50W LED sticker in a traditional street lamp shield to make a low-cost LED street lamp. The lamp shield is recycled from the conventional one. Therefore, we reduce not only the cost of power supply, but also the cost of lamp shield.

LED Sticker: thinnest LED Street Lamp

Thermal Thin Film has great thermal performance,
therefore, we don't need conventional LED heat sink with fins.
Here you can see: our street lamp only need a 4mm thick aluminum
as substrate, which is much cheaper than conventional heat sink.

No power supply, no heat fins, no heavy structure – here we present to you:
The thinnest LED street lamp ever.



30W LED Street Light Module

9W LED Headlamp (H4)

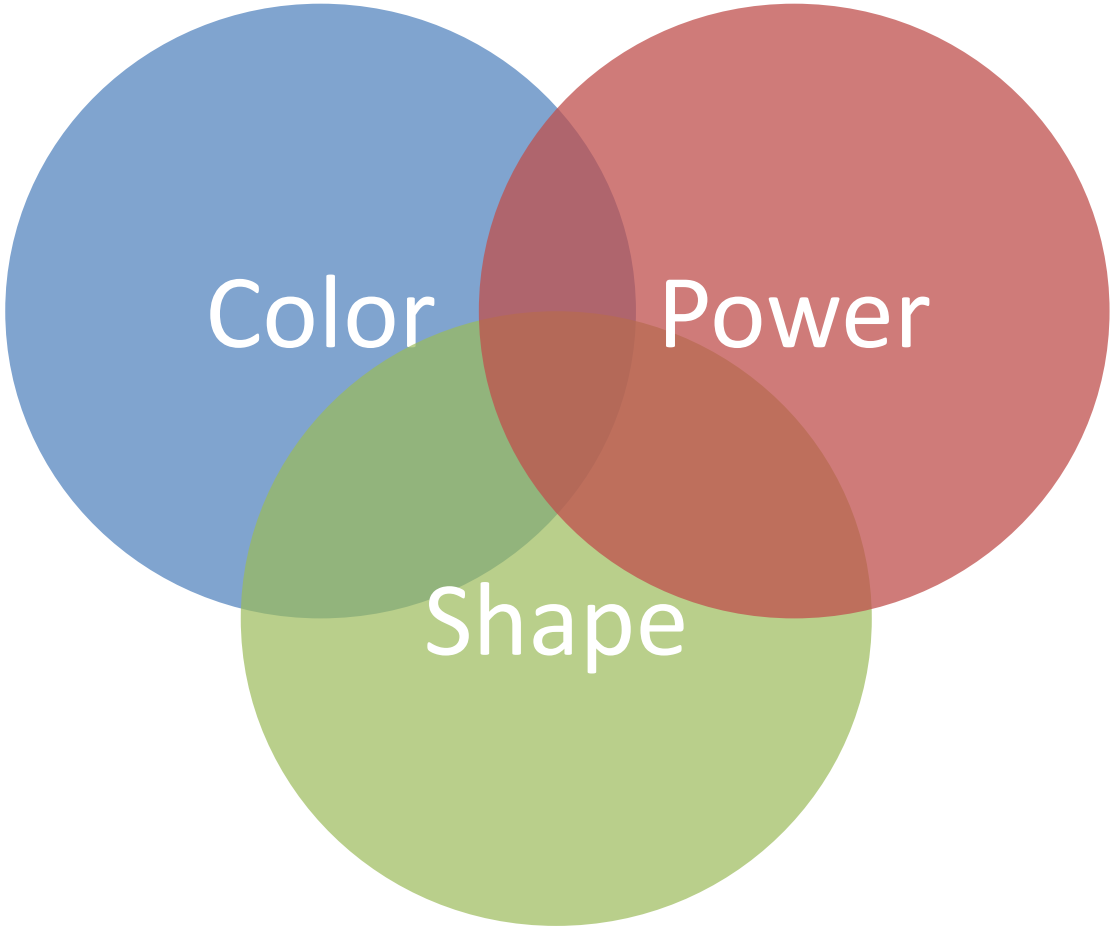
18W LED Bulb using 10W Sink

Glareless LED Tube Lamp (T8)

Smart LED Lamp: Change color by app

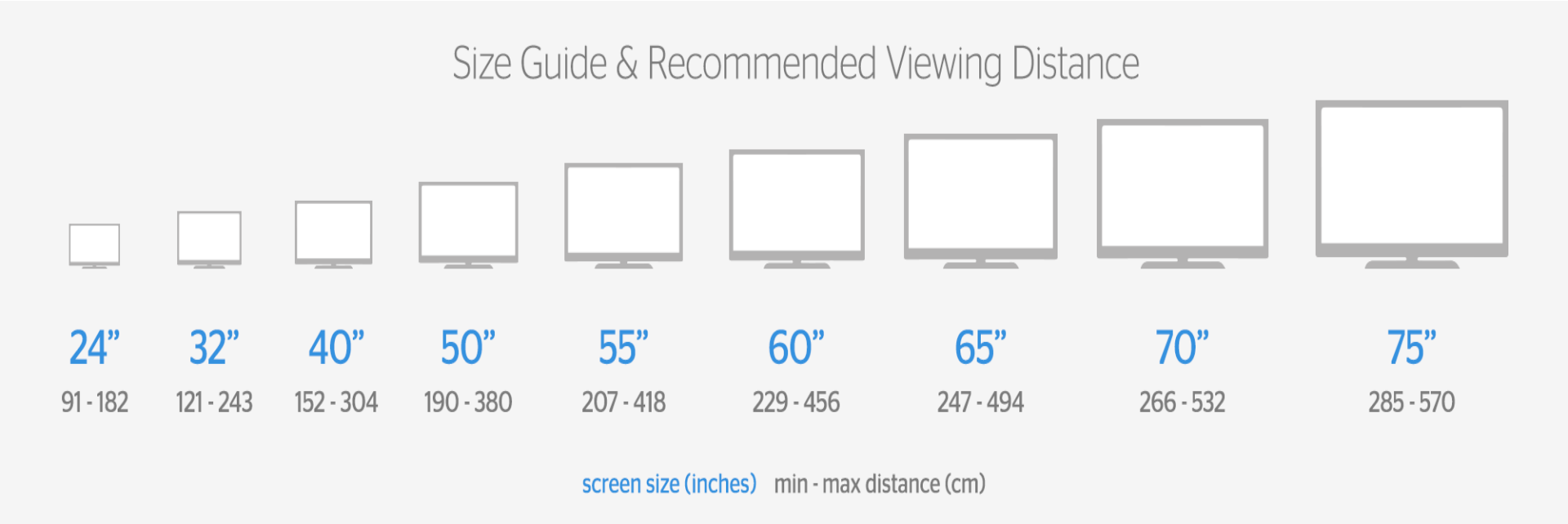
智慧顯示器

How to react and perform?



Better Color and Resolution Performance

Shape: Slim



The size and power is required larger and higher.

How about our tech?