1. INTRODUCTION

What is an embedded system?

➢ Controlling the real world with computers

➢ Computers that interact and control the real world, move between messy reality and tidy computers

Analog

Digital

Some Interesting Examples of Embedded Systems:

➢ Product: Sonicare Elite toothbrush.

➢ Microprocessor: 8-bit

➢ Has a programmable speed control,

   timer, and charge gauge

Some Interesting Examples of Embedded Systems:

➢ Are embedded systems?

Some Interesting Examples of Embedded Systems:

➢ Are embedded systems?

Some Interesting Examples of Embedded Systems:

➤ Product: NASA's Twin Mars Rovers.

Microprocessor: Radiation Hardened (抗辐射) 20Mhz PowerPC

Commercial Real-time OS

Software and OS was developed during multi-year flight to Mars

and downloaded using a radio link

Photograph courtesy of NASA/JPL CALTECH

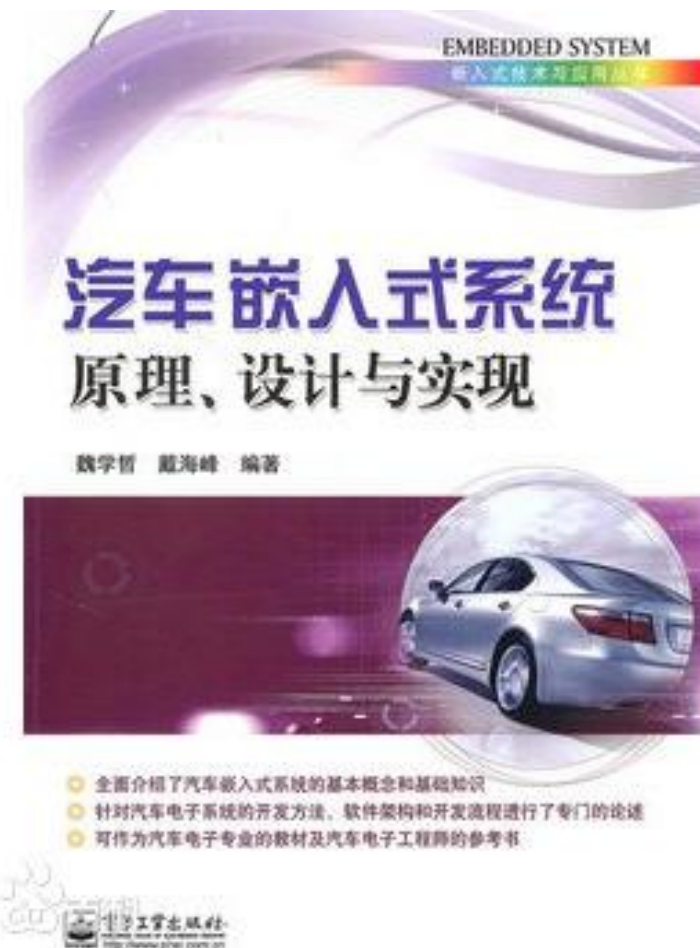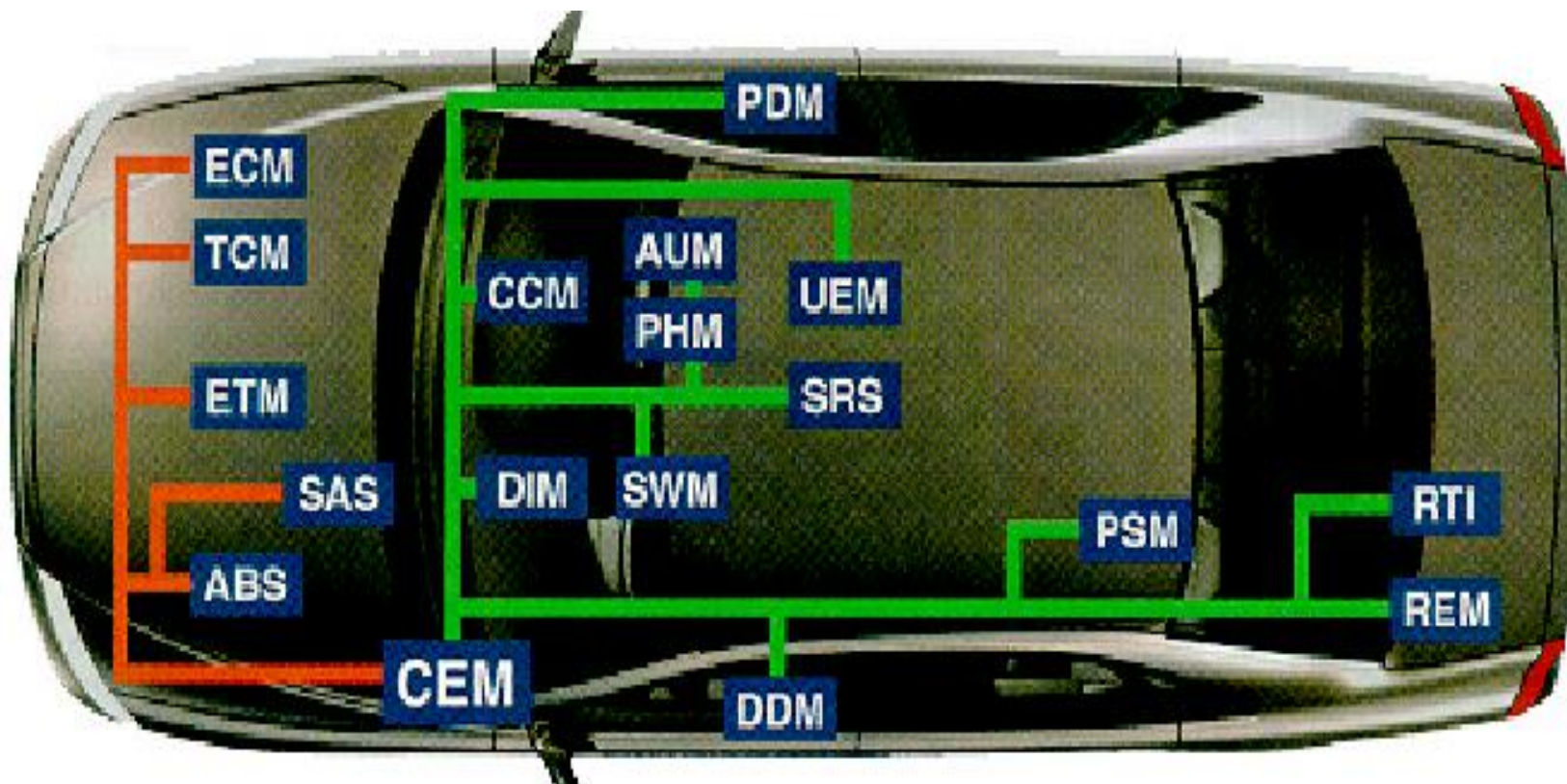# Some Interesting Examples of Embedded Systems:

➤ Are embedded systems?

用手势就能控制水量和水温的龙头

Some Interesting Examples of Embedded Systems:

Some Interesting Examples of Embedded Systems:

Examples cars

- AntiLock brakes（防锁死刹车系统）

- Ignition Control（点火控制）

- Emission Control（排放控制）

- Digital Dashboard

- Intelligent HeadLights

  - automatically dip when they detect on-coming traffic

Some Interesting Examples of Embedded Systems:

➢ Product: Any PC Mouse, Keyboard, or USB Device

Microprocessor:

8-bit Microcontroller

Some Interesting Examples of Embedded Systems:

➢ Product: Any Disk Drive

Microprocessor: Dual 32-bit Marvel ARM SOC & mixed signal DSP

Some Interesting Examples of Embedded Systems:

➢ Product: Any Printer

Microprocessor: Intel, Motorola, or ARM 32-bit RISC

Some Interesting Examples of Embedded Systems:

➢ Product: vending machine.

➢ Microprocessor:

  Two 16-bit Hitachi H8/300H Processors

➢ A robot hand dispenses items

Some Interesting Examples of Embedded Systems:

➢ Product: Video & MP3 Player.

➢ Microprocessor: TI TMS320 DSP

Some Interesting Examples of Embedded Systems:

➢ Product: Cannon EOS 30D Digital Camera

➢ Microprocessor: DIGIC II Image Processor

Some Interesting Examples of Embedded Systems:

➢ Product: Sony Aibo ERS-7 Robotic Dog.

Microprocessor: 64-bit MIPS R7000.

OS: Aperios - Sony's Real Time OS

Used in Robocup Soccer Teams

Some Interesting Examples of Embedded Systems:

➢ Product: Radiant Systems Point-of-Sale (POS) Terminal

Microprocessor: Intel X86 Celeron

OS: Windows XP Embedded

Look for one next time you order fast food!

Some Interesting Examples of Embedded Systems:

➢ Product: High End Systems DL2 Digital Media Server

➢ Microprocessor: X86

➢ OS: Windows XP Embedded

➢ Used for lighting effects in shows and rock concerts

Some Interesting Examples of Embedded Systems:

➤ Product: Microsoft's Smart Personal Object

Technology (SPOT) watch

Microprocessor: 32-bit ARM with FM Radio

Chip

Downloads News using extra bandwidth on

FM radio stations in major cities

Some Interesting Examples of Embedded Systems:

➢ Product: Kuka Industrial Robot Arm

Microprocessor: X86

OS: Windows CE OS & Others

Kuka robot arms welding a Mercedes

Some Interesting Examples of Embedded Systems:

➢ Product: Portable GPS Navigation & Multimedia System

Microprocessor: ARM , DSP

OS: Windows CE

Also plays MP3s and Videos

Some Interesting Examples of Embedded Systems:

➤ Product: Atronic Slot Machine

Microprocessor: X86

OS: Windows CE

Slots are networked to a casino's back office computer system. State Gaming agencies audit code and payoff odds.

Some Interesting Examples of Embedded Systems:

➢ Product: Dresser Wayne Ovation iX Gas Pump

Microprocessor: Marvel Xscale (ARM)

OS: Windows CE

Displays video ads & is networked to a gas

station's back office computer system. Also has

remote maintenance features.

Some Interesting Examples of Embedded Systems:

➢ Product: Bernina Artista 200 Sewing Machine

Microprocessor: Marvel StrongARM

OS: Windows CE

Can download new images

from the internet and sew them

Some Interesting Examples of Embedded Systems:

➤ Product: LG VoIP Phone

Microprocessor:

Freescale i.MX21 ARM

OS: Windows CE

Some Interesting Examples of Embedded Systems:
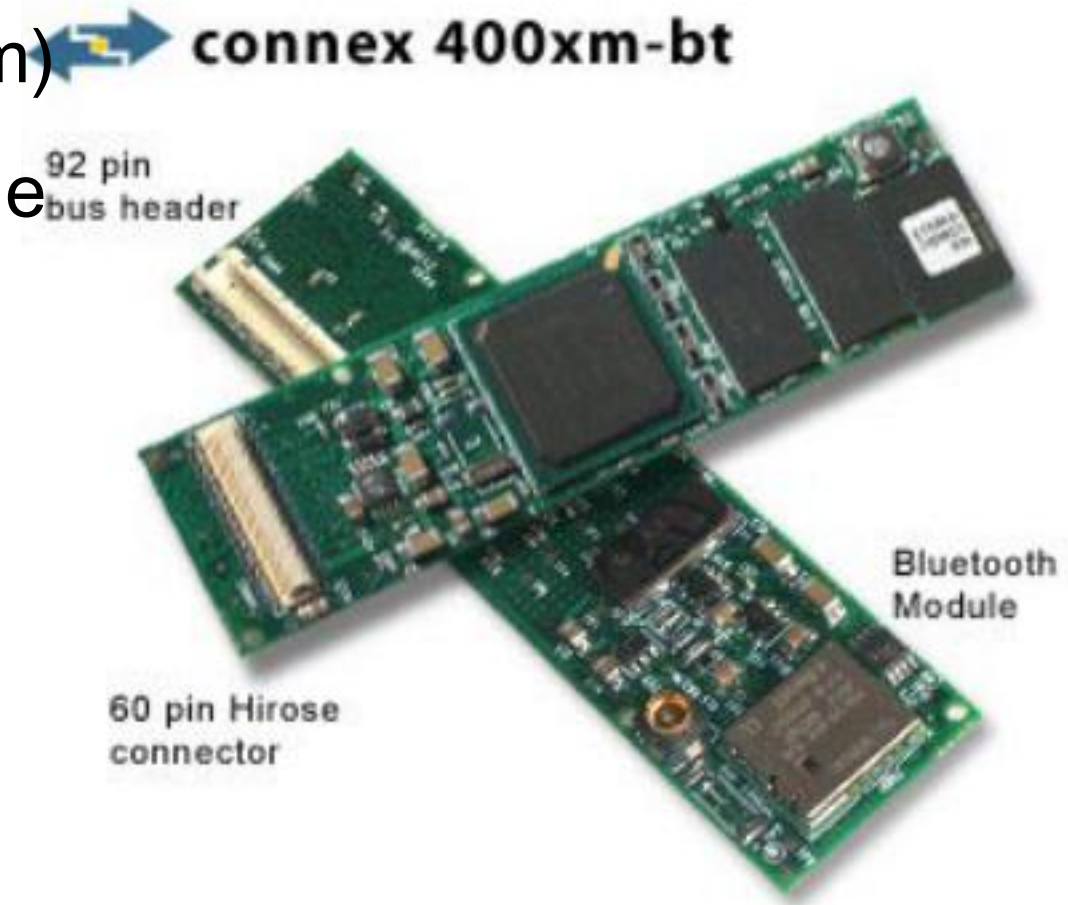
➢ Product: Gumstix Connex Embedded

Computer Board (size of a stick of gum)

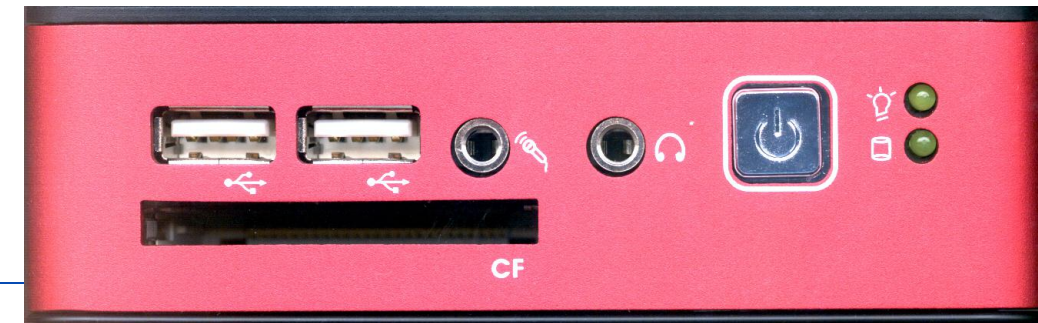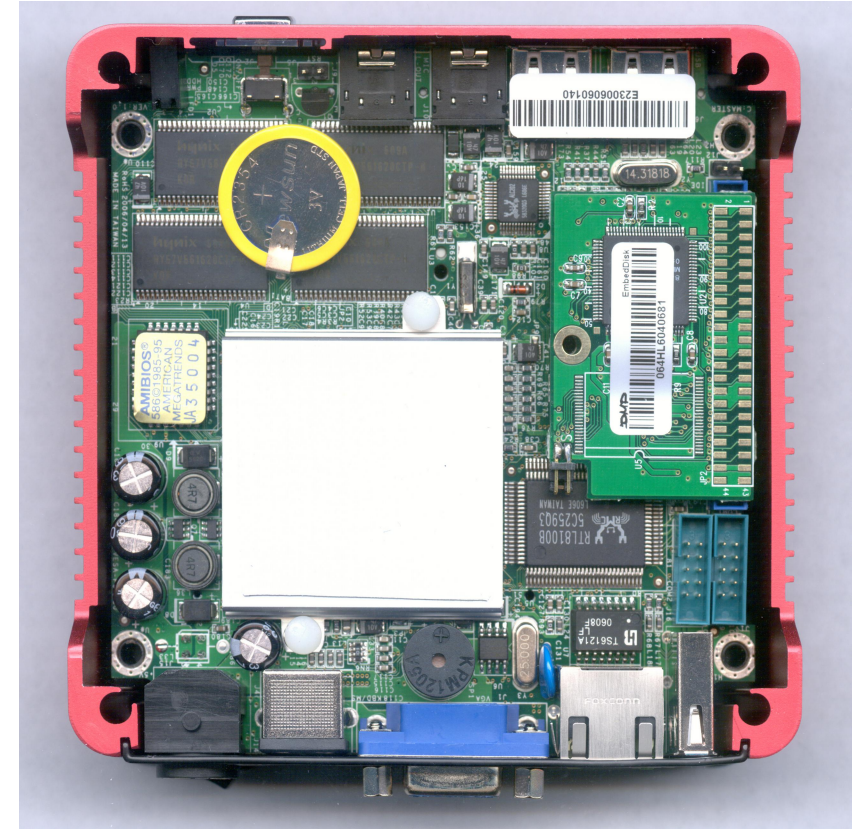Microprocessor: Marvel 400Mhz Xscale

OS: DrumStix community project

developing a BSP for Windows CE

Great low-power CE target board for

student projects.

connex 400xm-bt

92 pin
bus header

60 pin Hirose
connector

Bluetooth
Module

Some Interesting Examples of Embedded Systems:

➤ Product: ICOP Ebox 2300 System on a

Chip (SoC) PC (4.5 x 4.5 x 1.5 inches)

Microprocessor: 200Mhz Vortex86 (X86)

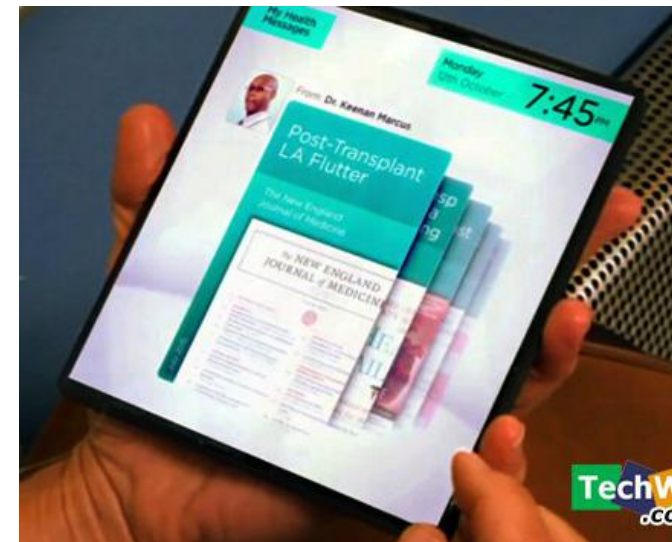OS: Windows CE

Low-cost CE target board for student

projects

Some Interesting Examples of Embedded Systems:

➢ Anti-terrorism

用电子病历终端机关心自己的健康

➢ 未来每个人自出生就能拥有属于自己的电子病例档案，方便医生根据病史对症下药。同时有个电子病历终端机，可以与医生视频会话，无需出门就得到健康咨询服务和治疗建议。

➢ Worrell公司设计了这款电子病历终端机，不仅可以更新记录自己的健康状况，还可以查询医疗服务，健康保健信息。预约医生，与医生线上沟通。目前适用于老年人和长期治疗患者。建立终身电子病历也会变成现实。
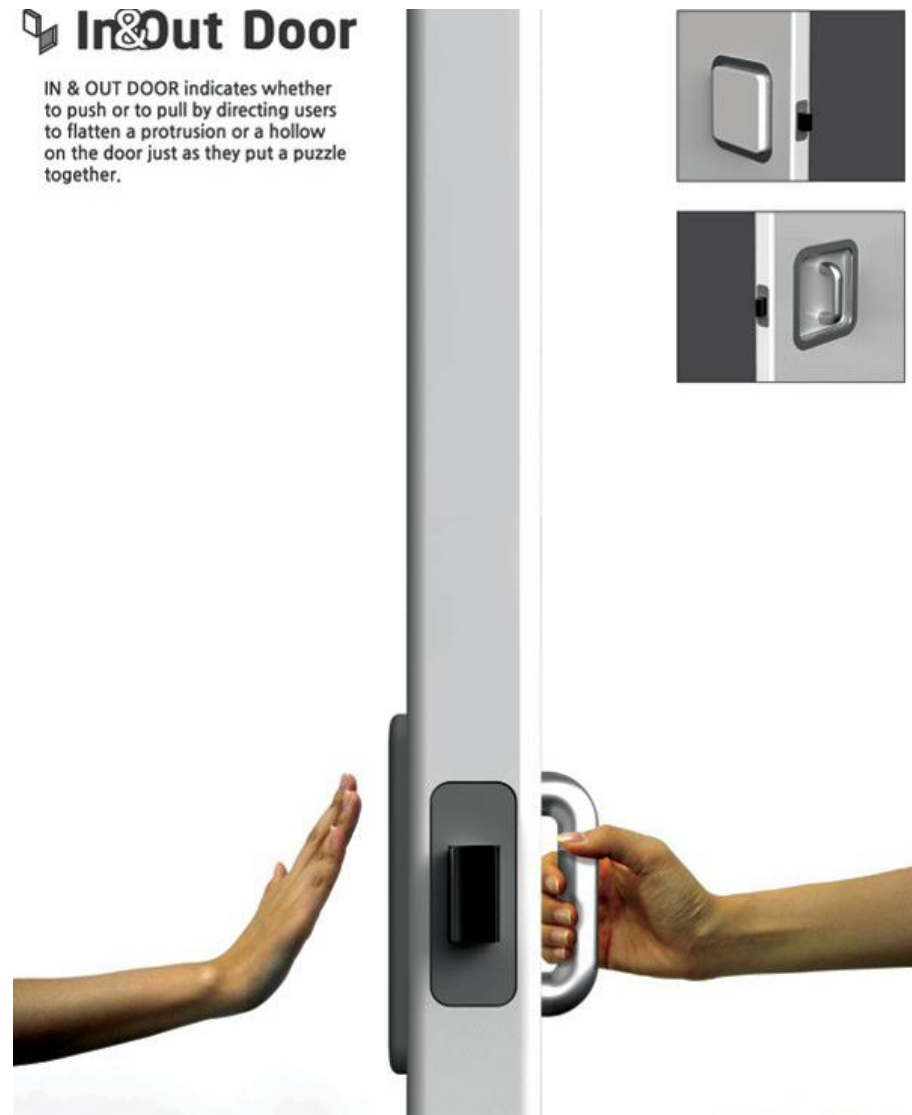
根据人本能反应设计的防风推拉门

➢ 设计公共场合推拉门的设计师一定感到很挫败吧，貌似没有几个人遵守门上的"推拉"二字，而且打开门后门会来回摇摆好几次才能关上。

➢ 那来看看这个进出门好了，需要推门进入的一面只有一个平板，人会本能的推，触动开关门就打开了，人进去后门会自动锁住，防止摇摆。而在需要拉的一边设计了把手，人会本能的拉动把手，握住把手的同时触动开关，门就可以打开了。

In&Out Door

IN & OUT DOOR indicates whether to push or to pull by directing users to flatten a protrusion or a hollow on the door just as they put a puzzle together.

量杯是多余的 精确出水量的水龙头

"自然醒" 光闹钟

➤ 你一定有过这样的体验。冬季的早晨，光线昏暗，还在熟睡中就被闹钟叫醒。感到浑身难受，不愿起床。而夏季早晨，同样的时间，光线明亮，想睡得晚都睡不着。

➤ 科学研究表明这种体验是很普遍的。这主要是因为人体生物钟受到了早晨光线的调节。夏季太阳出来得早，人体受到光线照射后，褪黑色素分泌减少，血清素分泌增加，人体新陈代谢加快，逐渐从熟睡到浅睡再到醒来。这个自然醒来的过程是舒适健康的。

➢ 但是在秋冬季和初春，由于太阳出来得晚，早晨光照不足。大部分人在醒来前没有经历早晨阳光的刺激。在被叫醒后，会出现情绪低落、心慌、感觉没睡醒等不适症状，严重者会导致冬季抑郁和季节性失调症。这也是不少人在冬季起床困难的一个原因。

➢ 不要小看了光线变化对自然醒来过程的影响。试验证明人类在夏季的平均睡眠时间要比冬季短一个半小时。在醒来后，身体机能从睡眠状态恢复正常也更快。

"自然醒" 光闹钟

➢ 现代社会，生活、学习、工作繁忙。当睡眠时间不足或者睡眠起床时间不规则时，由于身体没有经历自然苏醒的过程，也会在起床时出现没睡醒、心慌或者情绪低落这些感觉。

➢ 随着科学研究的深入，近年美国市场上出现了一种创新的电子产品，在室内模拟夏季早晨自然光线的变化。能够通过光线的作用让人在设定的时间自然地醒来。这样在任何一个早晨都能够拥有一个自然苏醒的过程。避免了闹钟突然唤醒对健康的伤害。醒来后，感觉也更舒适。

"自然醒"光闹钟

➢ 每个人都会有体验，自然醒来和被闹钟叫醒的感觉是完全不同的。人体从睡眠状态变化到清醒状态时，心跳、血压、体温、呼吸频率、脑电波都会发生变化。例如呼吸会从每分钟16次提高到每分钟24次，心跳每分钟加快10次，脑电波从每秒8次提高到每秒30次。如果这种变化是突然发生的，例如突然被闹钟叫醒。将可能使人产生心慌、情绪低落、感觉没睡醒等不适。其实用闹钟将人叫醒是违背了人体的自然习惯，日积月累会对健康造成影响。而"自然醒"则避免了突然唤醒对身体的损害。

"自然醒"光闹钟

➢ "自然醒"产品在您设定的时间前30分钟，开始逐渐调亮室内光线，引发人体对光线的自然反应，逐渐从深睡眠过渡到浅睡眠再到醒来。这个时间是经过科学测试的。通常情况下，大部分人会在设定时间前的15分钟内自然醒来或者过渡到浅睡眠状态。从这种状态下醒来是健康、舒适的。

"自然醒" 光闹钟

➤ 如果过于疲劳、严重睡眠不足，您也不必担心会睡过头。在到达设定时间后，"自然醒"会发出一个频率逐渐增加的提示音将您逐步唤醒。这个提示音也是"自然醒"人性化设计的一部分。由于它的频率是逐渐增加的，给人一个醒一醒的时间，尽量避免了突然唤醒给人的不适。

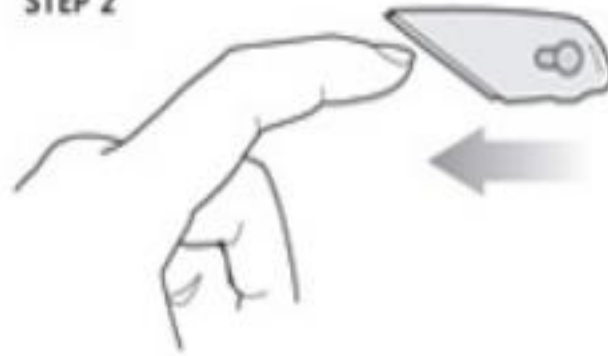➤ 体验一下早晨温暖阳光洒在脸上的感觉，一个美妙的早晨等着你。

结合手机使用的"智能购物车"

How to use

STEP 1

STEP 2

The **SMART FINGER** is divided into two parts and is used after each one is put into fingers a person wants. The distance between **SMART FINGER** put into fingers different from each other is directly displayed.

silicon with good flexibility

The silicon with good flexibility is used for the inside that a finger is put into, so it can be used for every thickness from a thumb to a little finger.

Examples House

➢ TV

➢ VCR

➢ CD music player

➢ DishWasher

➢ Washing Machine

➢ Radio Alarm

➢ Toys

Examples Medicine

➤ X-Ray Controller

➤ Blood diagnosis

➤ Magnetic Resonance Imaging (MRI)（核磁共振成像）

➤ CAT scanners（X射线轴向分层造影扫描机）

➤ Implanted Heart Monitors（可植入心脏监测器）

➤ DNA analysis

and …

➢ Digital watches

➢ Mobile Phones

➢ ATMs

➢ Robots

  ❑ Mars Explorer

  ❑ Landmine clearing

➢ GPS

What is an embedded system?

➢ Combination of computer hardware, software, and some mechanical parts,

➢ Designed to perform a **specific function**.

➢ General-purpose computer（通用计算机）is not designed to perform a specific function.

What is an embedded system?

➢ Installed in a larger system

❑ Eg: cars and trucks contain many embedded systems

➢ Existence of processor & software should be completely unnoticed by a device user

❑ Eg: microwave oven, VCR, alarm clock

What is an Embedded system?

Maybe you will say, " But all computers are programmed to perform tasks!"

You are right, however an embedded system is programmed to perform its task from the time it is powered up until it is shut down. Its programming **cannot be changed** except in ways that its original programmer intended.

What is an Embedded system?

An embedded system is a component of a larger system of some sort. Indeed, embedded systems may be nested within other embedded systems to arbitrary depth. Generally, the "higher level" embedded system is the more complex one, but this is not necessarily the case.

What is an Embedded system?

➢ An embedded system is a large or small **computer system** that **is built into** a product, a piece of equipment or another computer system, and that performs some task useful to the product, equipment or system.

➢ 嵌入式系统是以应用为中心，以计算机技术为基础，并且软硬件可裁剪，适用于应用系统对功能、可靠性、成本、体积、功耗有严格要求的专用计算机系统。

What is an Embedded system?

➢ It is a computer system that is programmed to perform a particular task.

简而言之，它是完成特定任务的计算机系统。

➢ Embedded Software Engineering

ENJOY THE COURSE !!!