Building Smart Outlets Using Arduino

Power Measurement and Control Unit and its Green Computing related research

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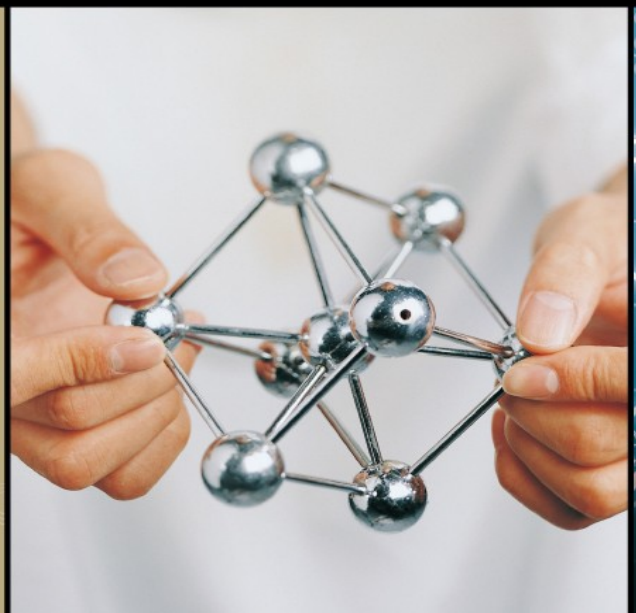
NCHC

National Center for High-Performance Computing

www.nchc.org.tw/en/



Keywords from Obama's 2010 Budget ...

- President Obama's 2010 Budget Highlights **Cloud Computing**

  Hidden keywords: ***Energy Efficiency , Green Computing***

- Hope for the Future: The **Smart Grid** Is Just What Obama Calls For

IMPROVING INNOVATION, EFFICIENCY AND EFFECTIVENESS IN FEDERAL IT

Businesses facing market pressures from which the Government is more insulated are forced to innovate, adopting emerging technologies with agility, to achieve maximum efficiency. Where appropriate, the Government needs to adopt innovations with the same agility.

Optimizing Common Services and Solutions/ Cloud-Computing Platform—The Federal technology environment requires a fundamental reexamination of investments in technology infrastructure. The Infrastructure Modernization Program will be taking on

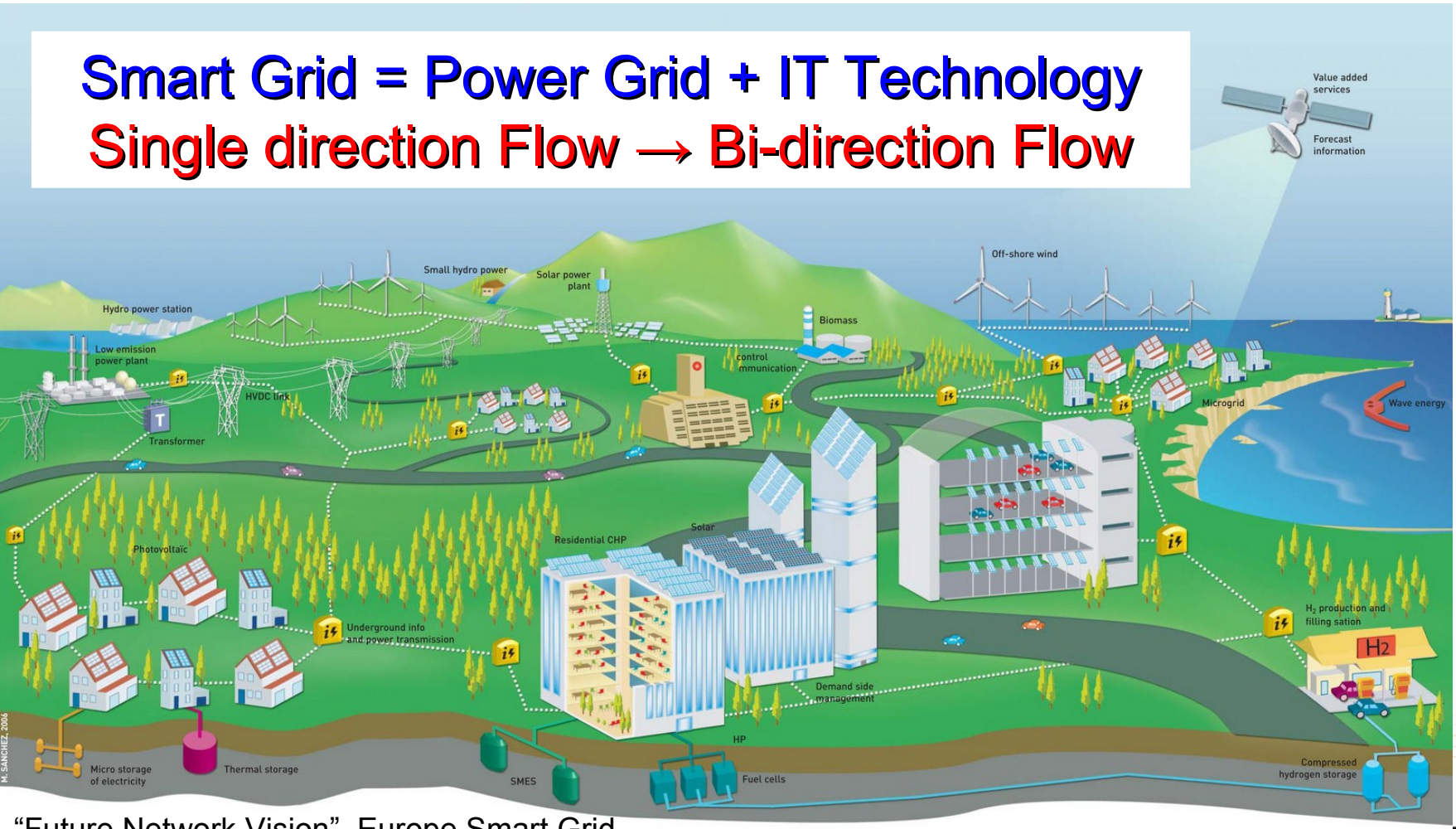
3 GAO, *National Cybersecurity Strategy: Key Improvements are Needed to Strengthen the Nation's Posture*, GAO-09-432T.

4 OMB Memorandum M-07–16, *Safeguarding Against and Responding to the Breach of Personally Identifiable Information.*

What is Smart Grid ?

Smart Grid = Power Grid + IT Technology

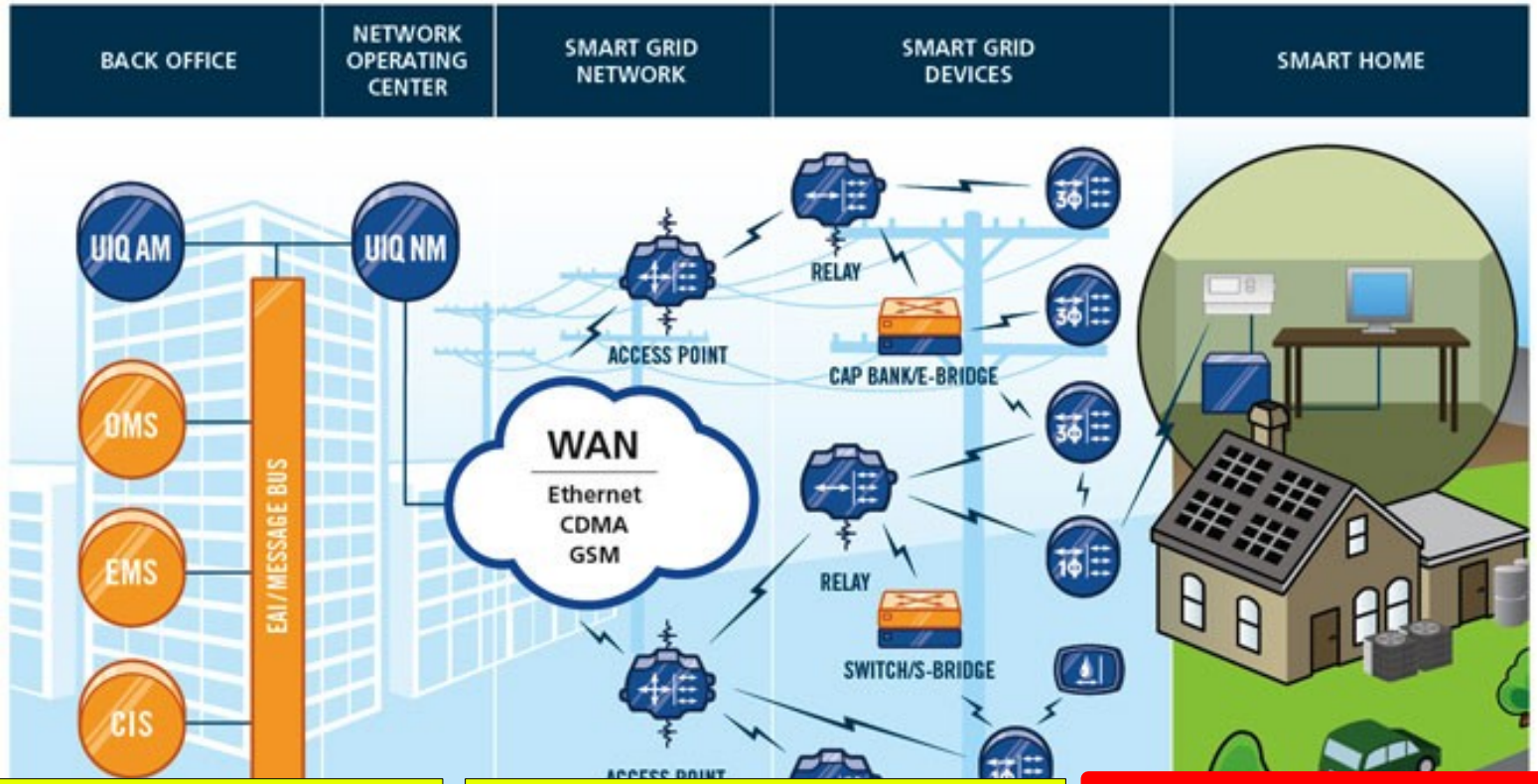
Single direction Flow → Bi-direction Flow



"Future Network Vision", Europe Smart Grid

Source : http://www.bareknut.no/diplom/wp-content/uploads/2009/05/smartgrid-illustration-by-eu.jpg

Three key components of Smart Grid



MDMS
Meter Data Management System

Smart Metering
Bi-direction Data Flow

Smart Home Appliance
Ex. Smart Outlet

Source : Silver Springs Network, http://earth2tech.files.wordpress.com/2008/04/silver-demo.jpg

What is Smart Outlet ?

- Smart Outlet could measure power consumption and control ON/OFF states of the electrical current while we're doing energy efficiency research.

Clip-On Sensor

A licensed electrician can simply install the Clip-On Sensor by attaching it to the main active or phase cable at the switchboard.

Receiver Unit

The wireless hand-held Receiver Unit can be taken from room to room or placed in a central location.

Transmitter Unit

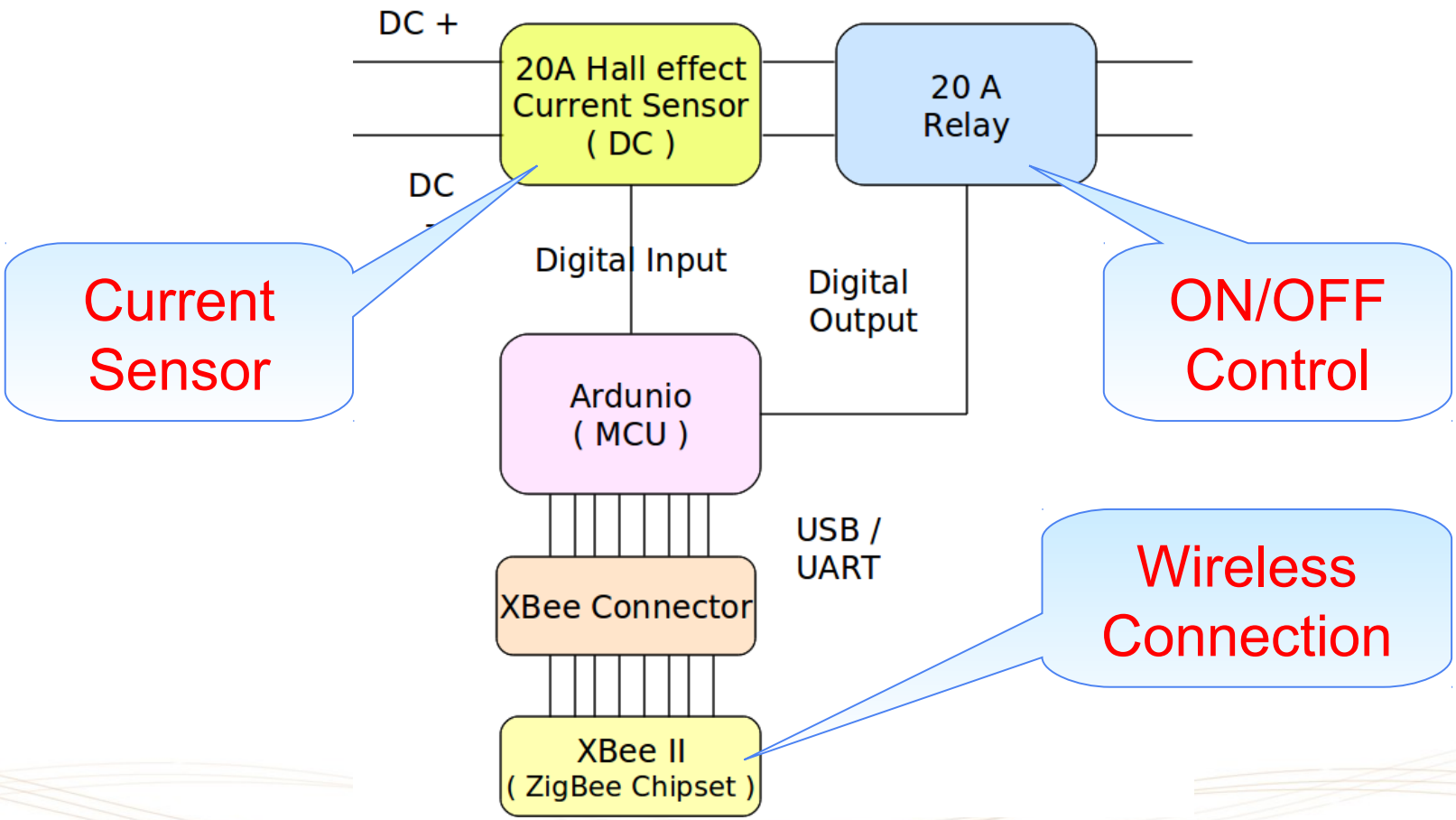
The Clip-On Sensor cable plugs into the Transmitter Unit which relays power use to the Receiver Unit.

Why we need NEW Smart Outlet ?

- Open Standard. No Vendor Lock-In !!
- Open Hardware. Cheaper Device ...
- Research of DC-Bus Micro-Grid. (not AC)
- Power Consumption Measurement Tool for Energy-Efficiency Research.

- It's kind of FUN!!

Hardware block diagram of Smart Outlet



Why we choose Arduino ?

- Open Hardware
- Growing Taiwan Arduino Community
- Simple Programming Language
- Full Support of Development Tools

Growing Taiwan Arduino Community (1)

English

2009 Coscup 開源人年會

Conference for Open Source Coders, Users and Promoters

2009/8/15-16

臺灣大學應用力學研究所 國際會議廳

首頁 | 議程 | 報名 | 公告 | 會場 | 贊助單位 | 活動簡介 | 吉祥物甄選 | 福利社

演講摘要

8/15

13:30 -14:00	Javascript 起飛到雲端 周立瑋 "sleepnova" Video Slide	開放源碼硬體開發套件(Arduino)對於設計與創作的影響 吳冠穎 "MAO" Video Slide

贊助單位

Diamond Level

0xlab

COOIDEA

YAHOO! 奇摩

Growing Taiwan Arduino Community (2)

台灣使用者社群
arduino.tw
INTERACTIVE • SOLUTIONS

什麼是Arduino? | 課程 | 文章 | 程式語法 | 論壇 | Download | 雜貨店 | 關於我們 | AVR MEGA | Eagle PCB

FLASH AS3 & Arduino in MAC

站長Blog文章單元 - 連接第3方軟體類(flash, processing, java, max/msp, virtoo)

作者是 xlinx

週日, 21 十一月 2010 16:51

在Mac中接收Arduino經SerialCOM傳來資訊轉發到socket給flash接收

MAC範例下載: link （在config設定檔中設定的tty應改成cu,例如serial_device1=/dev/cu.usbserial-A9007KyX）

Windows 範例教學連結: link

http://arduino.tw

文章分類

- 什麼是Arduino?
- 課程
- 文章
- 程式語法
- 論壇
- Download
- 雜貨店
- 關於我們
- AVR MEGA
- Eagle PCB

網站連結

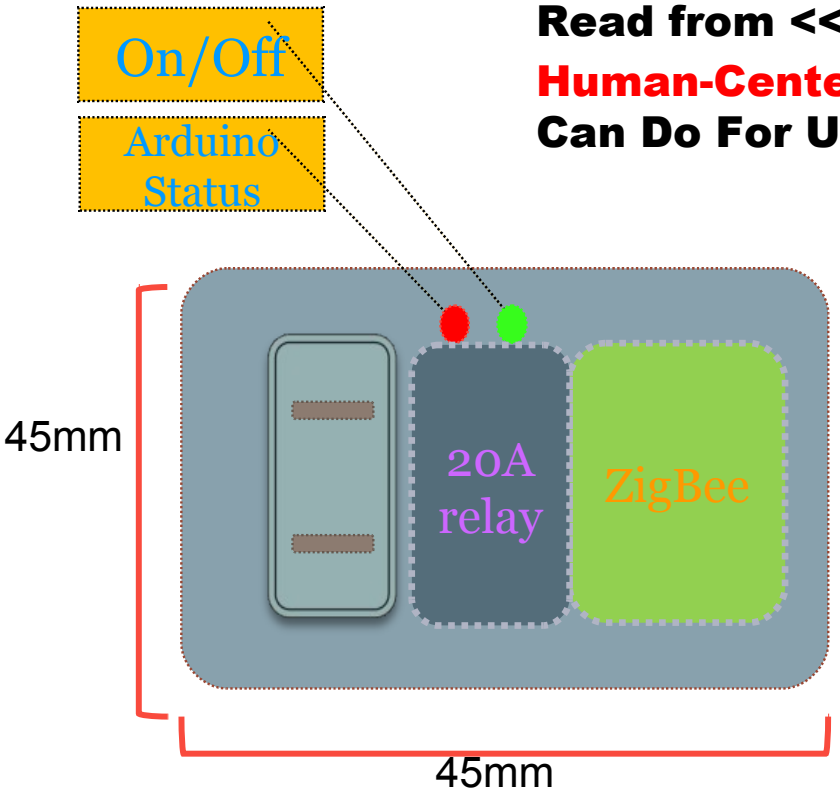
ArduinoTW 書籍

PChome線上購物 誠品網路書店

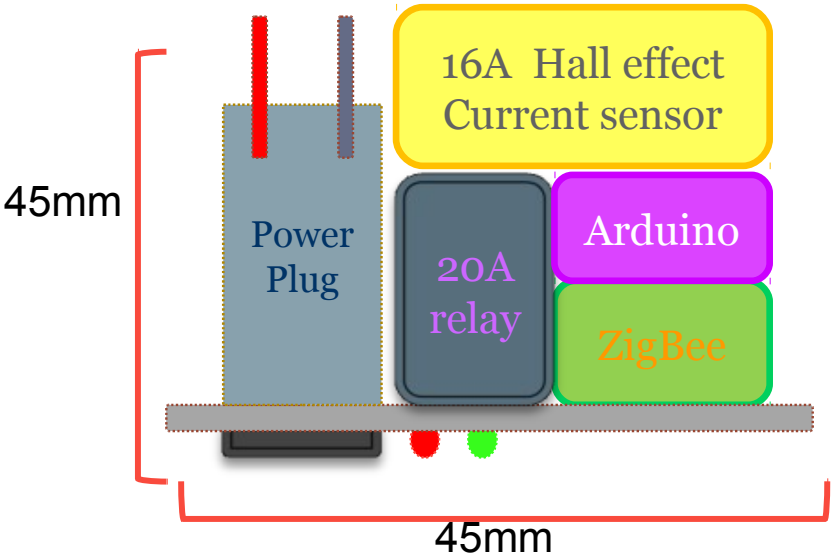
最新文章

Design Concept : Silence Changes ...

Read from << The Unfinished Revolution: Human-Centered Computers and What They Can Do For Us >>

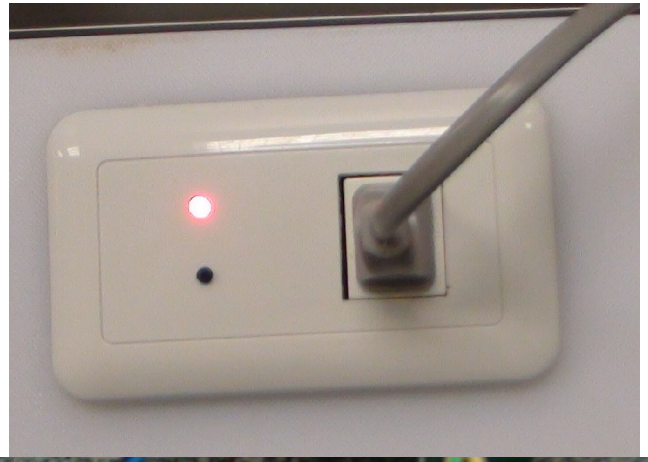


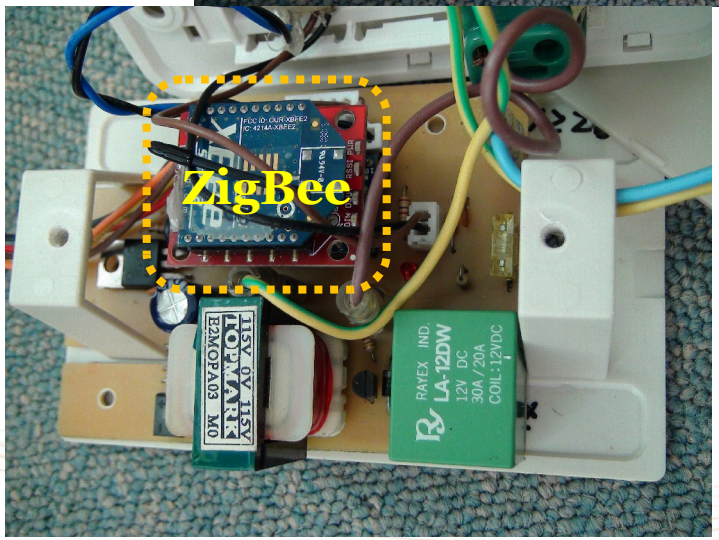
《 Front Side 》

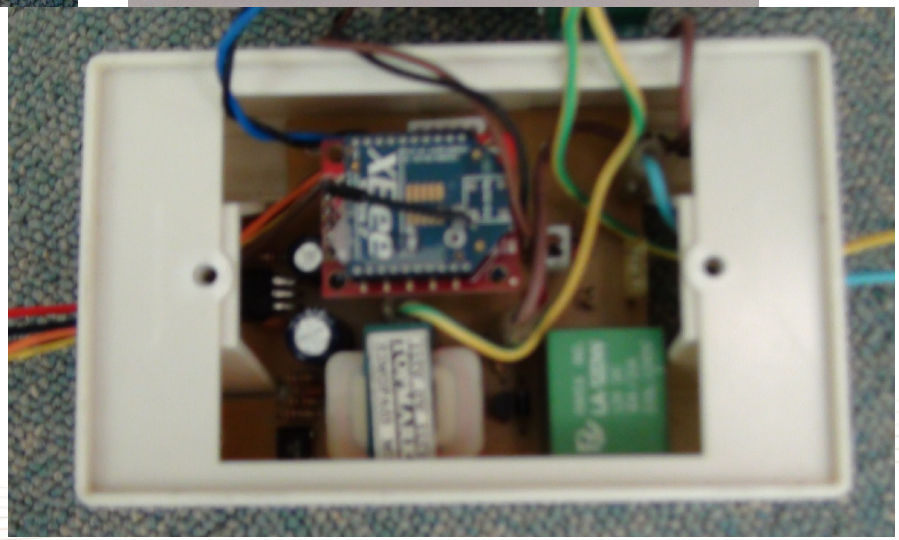


《側面圖》

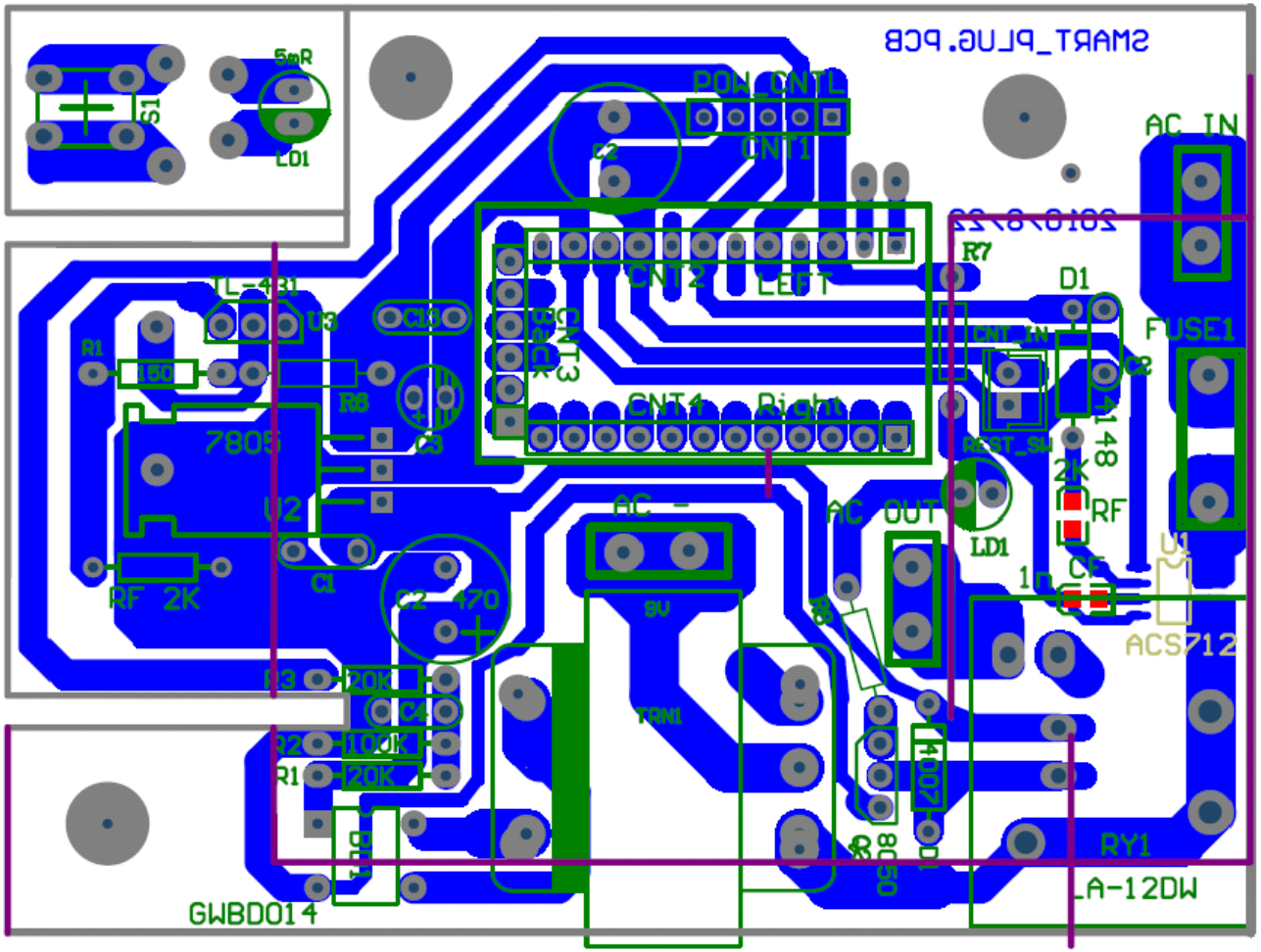
Our Smart Outlet



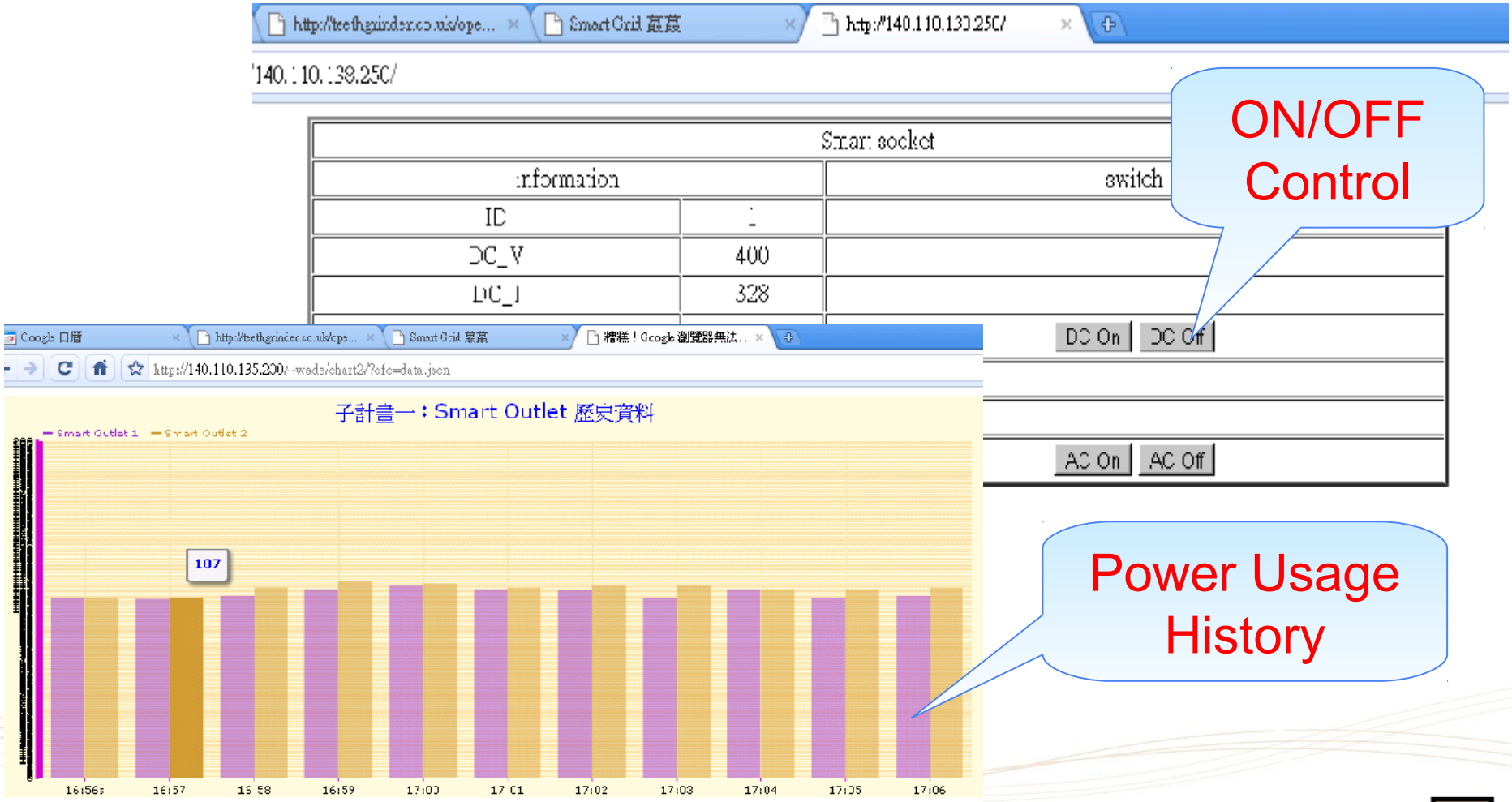




PCB Layout of Smart Outlet

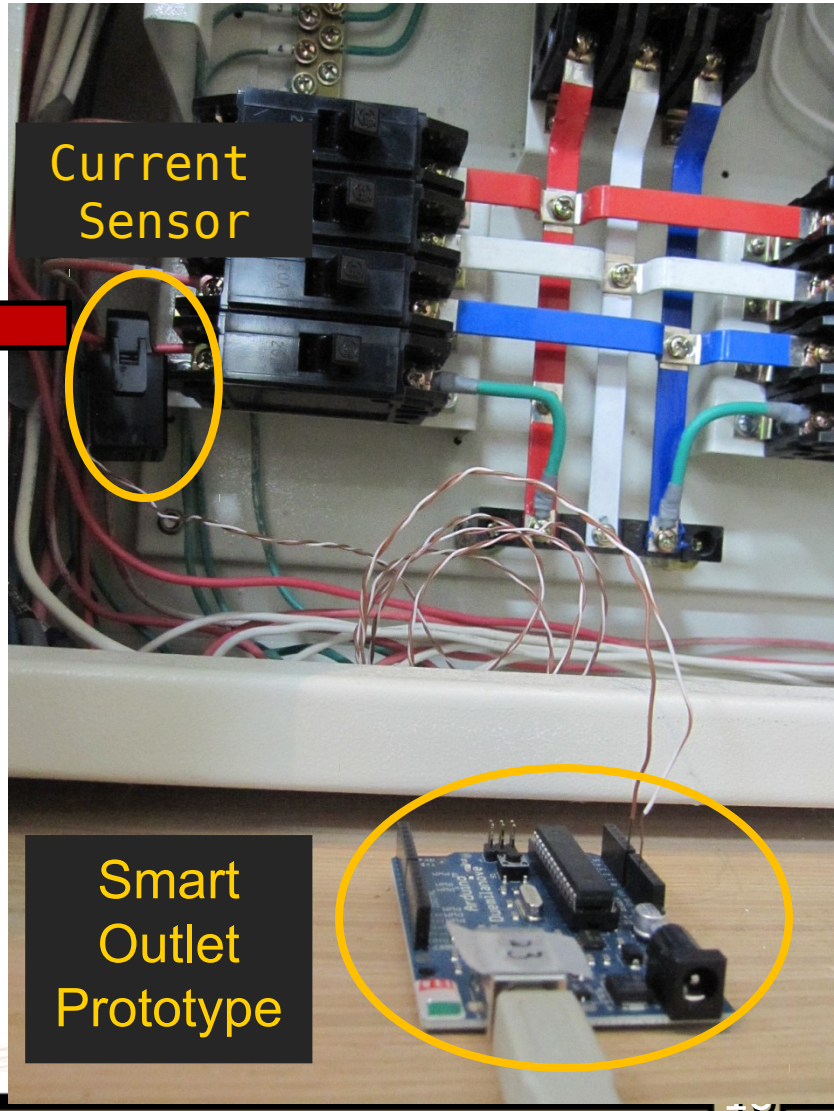


Web UI of our Smart Outlet



Applications:

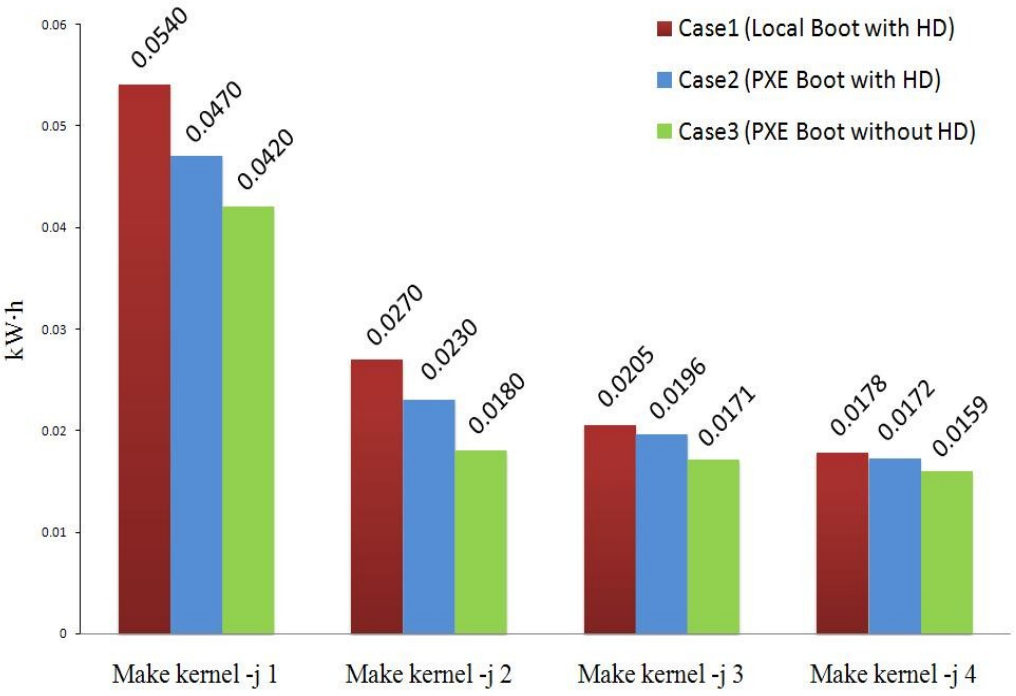
Power

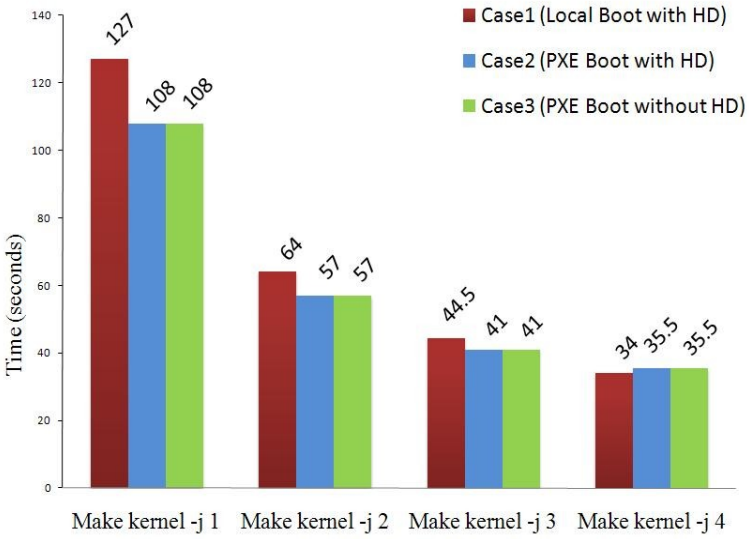


We use smart outlet to do energy efficiency relate research in PC classroom.

Experiement Results

It saves 33.33% with diskless architecture





For more details …

- Please refer to following papers:
- "E2CC: Building Energy Efficient ClassCloud using DRBL", IEEE Grid 2009
- "A Power-Aware Cloud Architecture with Smart Metering", ICPP 2010

Questions ? Comments ?

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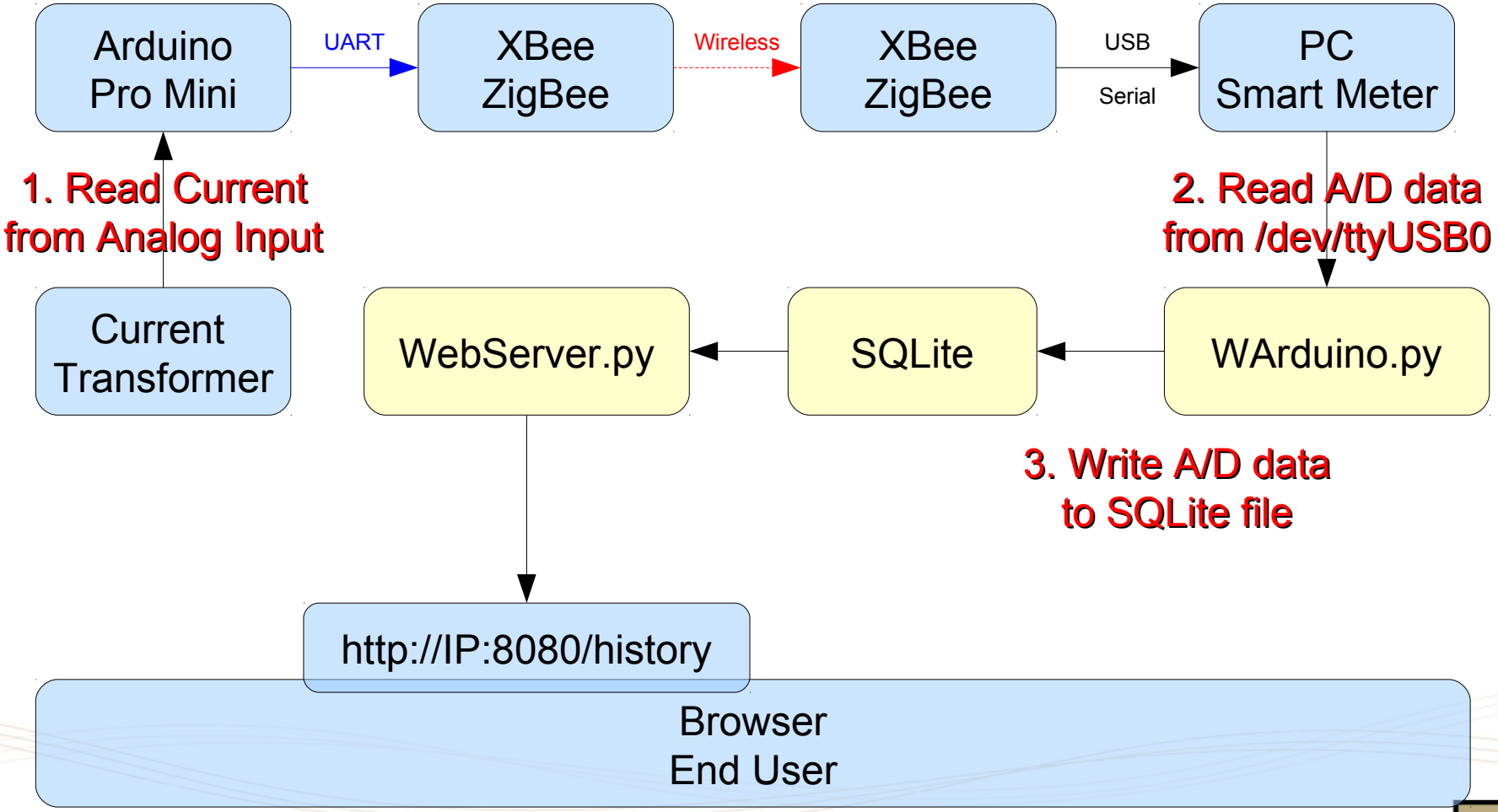
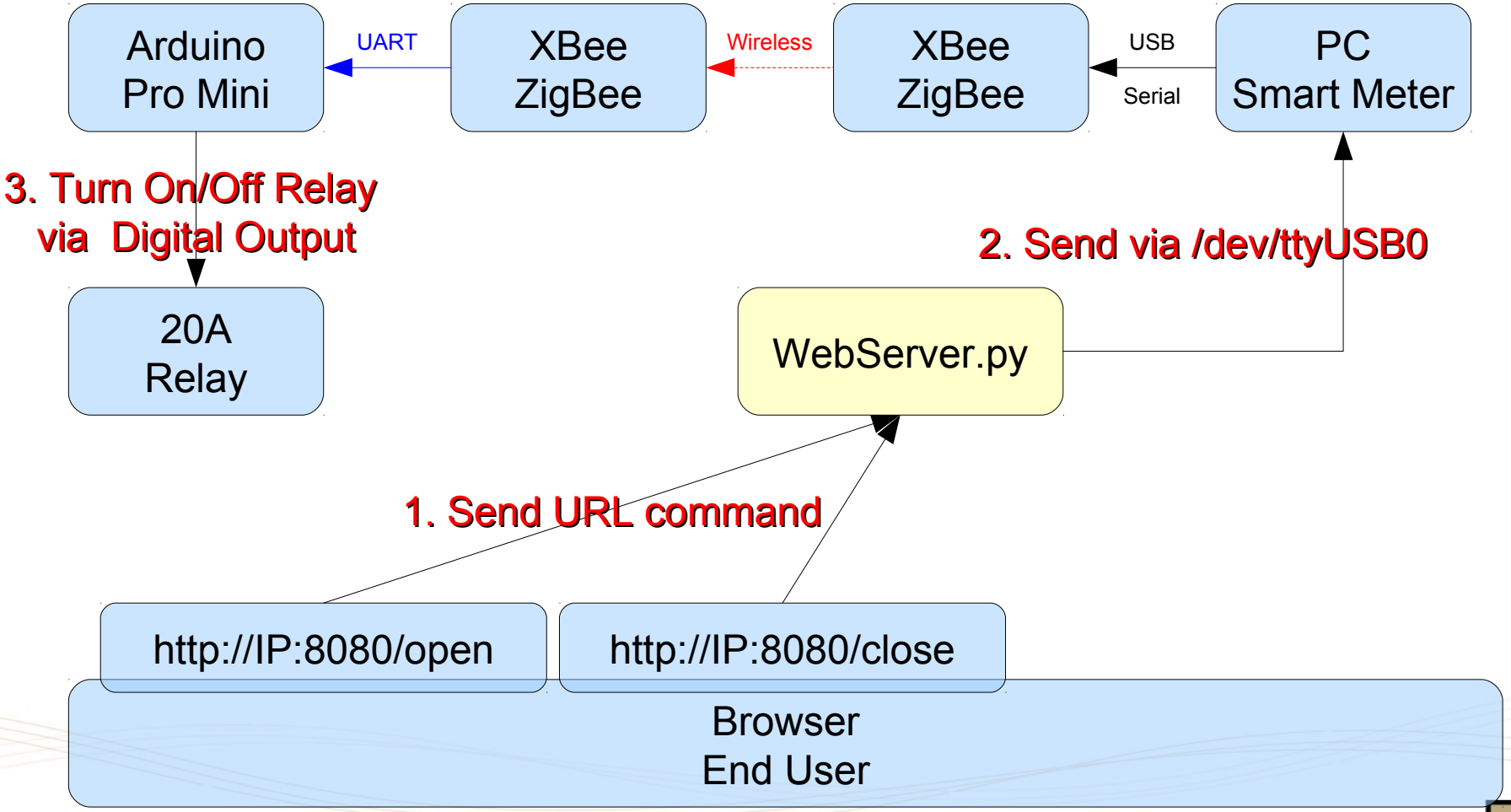
DEMO: System Data Flow Diagram (1)



DEMO: System Data Flow Diagram (2)



Future Work ?!

1. Reduce the hardware cost of this prototype
2. Project website: http://i-plug.sf.net
3. More application and demo sites

Comments ? Questions ?