Sensing the World Around You – With Linux and other bits

Brian DeLacey
BLU @ MIT, 5/20/2015
Agenda

- 6:30 - 7:15 - Jerry and John, open BLU discussion
- 7:15 - 7:45 - Zigurd Mednieks, "Orders-of-magnitude-advances in Sensing Technology"
- 7:45 - 8:30 - Brian DeLacey, Technical hands on hacking with sensors and TI's new MSP432 on Linux
- 8:30 - 9:00 – Discussion – Arun, Zigurd, Brian, All
  - General Questions
  - Sensing technology and IoT
  - What is the O/S for the Sensing world?
  - Give Away Items thanks to Texas Instruments

Details and Recap at http://blu.org/cgi-bin/calendar/2015-jun
Spoiler Alert: Lessons Learned

- Familiar and Fun
- Relatively Low Cost
- Vast Introduction to Landscape of
  - Computers / Hardware
  - Electronics
  - Programming / Software
  - Communications / Radios / Wireless
  - Real-world, Sensor-based applications
- Some tricks you’ll learn on the fly
  - Flaky cables, shared power rails, beware the motors
End Result: IoT Network Topology

Manage Data Locally While Sharing Globally
With User-Controlled Programs and Preferences

- Linux Box: 192.168.6.30
- Actiontec MI424WR GigE: 192.168.1.1
- TP-LINK TL-WDR3500 Wireless N600 Dual Band Router OpenWrt: 192.168.6.1
- TI SimpleLink Wi-Fi CC3200 LaunchPad: 192.168.6.10
- TI MSP432 LaunchPad CC3100 WiFi: 192.168.6.20
What are you sensing?

Find your solution now at ti.com/sensing

Dear Brian,

We invite you to learn more about Texas Instruments (TI) industrial sensing solutions in this exclusive webinar. The presentation will introduce TI’s sensing portfolio, and share how TI components address design challenges across various applications, including:

- Temperature
- Humidity
- Optical
- Current
- Capacitive sensing
- And more!

We will hold two identical sessions to accommodate time zones. Both sessions will conclude with an interactive Q&A, so bring your questions! We look forward to speaking with you!

Webinar details
Session 1
Date: May 21, 2015
Time: 11:00 am Eastern Time
Duration: 1 hour

Add event to your calendar

Webinar details
Session 2
Date: May 21, 2015
Time: 2:00 pm Eastern Time
Duration: 1 hour

Add event to your calendar

http://www.ti.com/sensing
Texas Instruments - Sensing

http://www.ti.com/sensors

What are you sensing?

- Biosensing
- Gas
- Material composition
- Proximity
- Chemical
- Humidity
- Occupancy
- Temperature
- Current / power
- Level
- Position / motion
- Pressure
- Flow
- Light
CC2650STK-SimpleLink™ Bluetooth Smart®/Multi-Standard SensorTag

TI Sensor Tag

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<td>Beacon support</td>
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<tr>
<td>DevPack support</td>
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<tr>
<td>Mesh network</td>
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<td>1 year (1 second report interval)</td>
<td>1 year (1 second report interval)</td>
<td>1 year (1 second report interval)</td>
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<td>App</td>
<td>App, Web</td>
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“In 2015, a modern-day gold rush has taken the technology sector by storm.”

“The solution lies not in the internet of everything, but rather the internet of some things, which may include brand-new investments in new “smart” assets. Or more likely, tapping into existing sensor networks and equipment with embedded intelligence which have been sitting idle.”

http://techcrunch.com/2015/05/19/the-internet-of-some-things/#.ffl8cn:OFBk
Data Mining, in your backyard

A really good overview ...
http://rayli.net/blog/data/top-10-data-mining-algorithms-in-plain-english/

Top 10 Data Mining Algorithms

1. C4.5
2. k-means
3. Support vector machines
4. Apriori
5. EM
6. PageRank
7. AdaBoost
8. kNN
9. Naive Bayes
10. CART
LaunchPad EcoSystem

Let’s focus on these two...

CC3200-LAUNCHXL

$29.99

MSP-EXP432P401R

$12.99

And programming with Energia...

Prototyping Software to Make Things Easy

03/24/2015 – Energia 15 is available! The release is available for download from [here](#).

Aside from bug fixes this release adds support for the new ARM Cortex M4F based MSP432 LaunchPad. This time it’s a bit different though! The framework is powered by TI-RTOS letting you run your Sketches in parallel. Yes, in parallel! How awesome is that?! This release supports MT for the MSP432 LaunchPad with other boards support coming in future releases. Find out more about multitasking @ [Energia MT](#).

So, what is this all about then?

Energia is an open-source electronics prototyping platform started by Robert Wessels in January of 2012 with the goal to bring the Wiring and Arduino framework to the Texas Instruments MSP430 based LaunchPad. The Energia IDE is cross platform and supported on Mac OS, Windows, and Linux. Energia uses the [mespgc](#) compiler by Peter Bigot and is based on the [Wiring](#) and Arduino framework. Energia includes an integrated development environment (IDE) that is based on [Processing](#).
Installing Energia MT for TI-RTOS
Multi-Tasking Real-Time Operating System with low-cost SOCs

http://energia.nu/guide/multitasking/
Maybe, Some Configuration

[File, New Configuration]

Then click on “Service Pack Programming”

When you are prompted to restart, just press the RESET button (SW1)
Pin Mapping – CC3200

http://energia.nu/pin-maps/guide_cc3200launchpad/
Pin Mapping – MSP432

http://energia.nu/pin-maps/guide_msp432p401r/
What are Booster Packs?

SimpleLink Wi-Fi CC3100
$19.99
http://www.ti.com/tool/cc3100boost

Grove Starter Kit for LaunchPad
$59
# Example App Pin Mappings

## MSP432

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## CC3200

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Weave it into IoT Network Topology

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- **TI MSP432 LaunchPad CC3100 WiFi**: 192.168.6.20
Energy Efficient - Try Solar!
“OpenWrt is described as a Linux distribution for embedded devices.”
Energia Futures

- Addition of Libraries
  - Tone()
- Support for additional LaunchPads
  - CC3200
  - SensorTag
- Future is Multi-Tasking
  - No new “native” ports, but some single-task optimizations when running TI-RTOS
- And more goodness …
Where to find parts? Sensors?

- Colored buttons from http://www.adafruit.com
- Jumper cables and accessories from Amazon.com
Think Modules too ...

Red Bear Labs

Introducing our new WiFi boards

RedBearLab CC3200  WiFi Mini

Available Now US$39.9

http://redbearlab.com/
Lessons Learned

- Familiar and Fun
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"What is the operating system of the sensor world?"

Panel Discussion
- Zigurd Mednieks
- Arun Thomas
- Brian DeLacey
Next Month, Next Meeting

Kurt and team were away for this meeting competing in Taiyuan City, China with the Asia SuperComputer Community.

Kurt returns for the 6/17/15 Meeting to talk about

*Linux in Supercomputing: Trends in High Performance Computing*