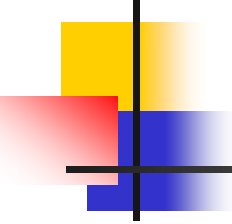


Power-over-Ethernet Gateway for Low-Power Wireless Devices

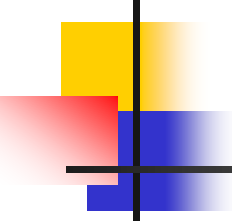


ECE 480 Design Team 03
Fall 2009



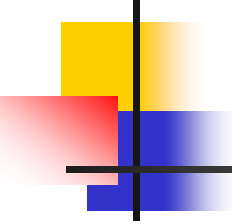
Power-over-Ethernet Gateway for Low-Power Wireless Devices

- Hassan Abdullahi
- Karthik Hemmanur
- Sasang Balachandran
- Dave Deluca
- Kang Hu Lee
- Prof. Jian Ren (Facilitator)
- Web @ <http://www.egr.msu.edu/classes/ece480/goodman/fall09-/g-roup03/>



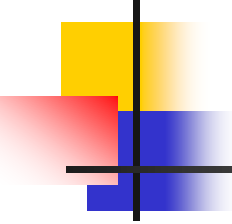
Power-over-Ethernet Gateway for Low-Power Wireless Devices

- Design and develop a deeply embedded PoE (Power over Ethernet) gateway to low power wireless devices
- The gateway would allow wireless sensor networks to be connected into a LAN for data/ information retrieval
- Applications include
 - Building
 - Home control,
 - Active sensing for industrial
 - Homeland-security
 - Agriculture
 - Medical and health
 - And More ...



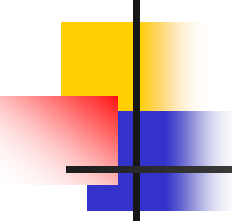
Executive Summary

- Given the growing concern for power savings...
- Power outlets may not be available at remote locations
- Engineers are now looking to tackle the situation with Power over Ethernet



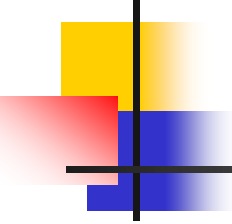
Executive Summary

- Interaction with the wireless sensors accessible with-in the range
- A prototype design which can accomplish this using parts and software provided by TI
- This solution promises effective means of monitoring, as well as cost and power savings



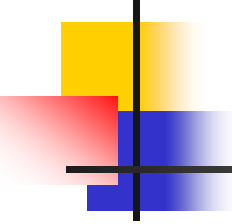
Introduction and Overview

- Power over Ethernet (PoE)
 - Technology utilizes Ethernet to both power devices and transmit data on one cable
 - similar to Universal Serial Bus (USB)
 - effective implementation would be
 - using wireless transmission to monitor sensor information on a periodic basis
 - The advantage of this system is
 - the convenience of low-cost implementation
 - not requiring an AC power source



Introduction and Overview

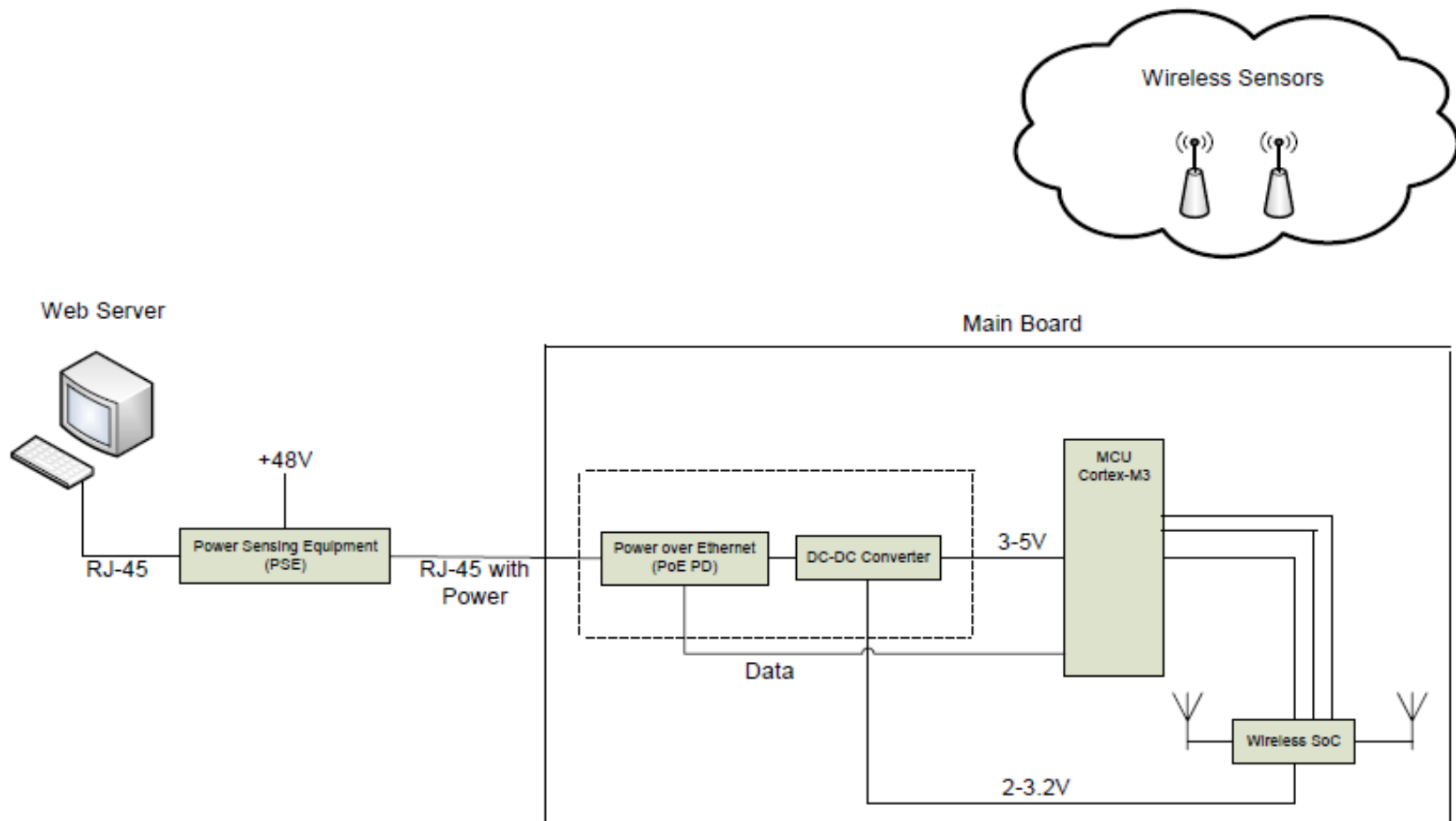
- Sensors
 - There is a growing demand for the use of sensors in many applications
 - Ranging from industrial to commercial markets
 - Monitor various environmental conditions
 - Web based gateway to periodically monitor and control all connected sensors
 - The gateway is remotely accessed through the Internet

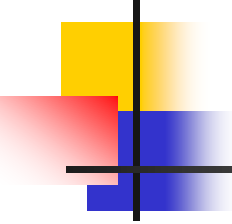


Introduction and Overview

- ECE 480, Design Team 03 will...
 - develop a PoE gateway that will use wireless protocols 6LoWPAN and Zigbee
 - By using the Stellaris Cortex-M3 LM3S8962 Microcontroller
 - Will incorporate wireless communication which will serve as a gateway for our sensors
 - Extendibility both in hardware and software terms
 - Constraints include
 - Time
 - Cost
 - Power
 - Performance

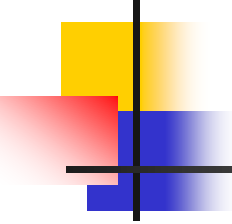
Design Flow





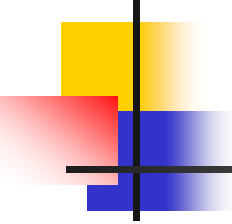
Design Specs - PoE

- Use Power Sourcing Equipment (PSE) to send power over standard Ethernet cable(CAT-5)
- Powered Device (PD) senses any power present on cable
- DC-DC conversion



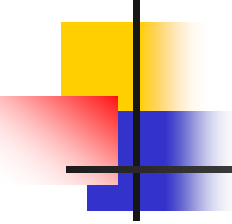
Design Specs - Microcontroller

- Central control of data flow
- Ethernet cable is only source of power (3-5V)
- Establishes link between web server and wireless data input
 - Input: Wireless data from sensors
 - Output: Processed data for user analysis



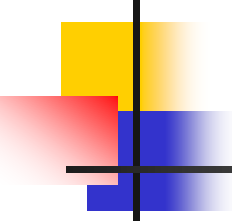
Design Specs – Wireless Communication

- Wireless System on Chip (Soc)
- Receives data from Sensors, transmits to MCU
- Powered by Ethernet cable (2-3.2V)
- Uses low-power protocols (Zigbee)



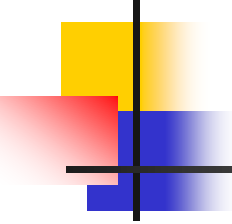
Design Specs - Sensors

- Detect and send environmental readings wirelessly
 - Temperature/Humidity
 - Motion
- Preprogrammed with Zigbee protocols
 - Minimal transmission rate
 - Ad hoc routing



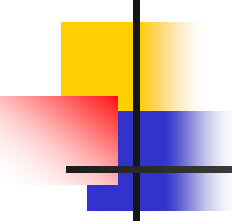
Ranking of conceptual design

Design Criteria	Weight	Power over Ethernet	Radio Communication	Web Server
Performance	5	4	5	5
Cost	5	5	5	4
Expandability	4	2	5	4
Power	4	5	5	3
Robustness	3	4	4	2
Size	3	3	4	1
	Total	94	114	82



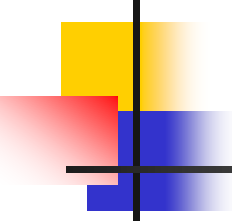
Risk Analysis

- According to IEEE 802.3af for PoE, a minimum power of 15.4 W is available to the board at 350mA, 44VDC.
- Potential hazard from +48V DC power supply required for PSE device
- Work on the board and its integration will involve minimal direct electrical currents.
- Using basic lab skills and prudent judgment, the team will take appropriate measures to avoid electrical hazards.



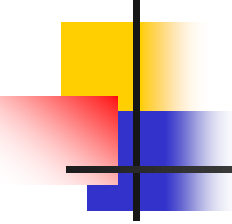
Budget

- Texas Instruments has agreed to provide us with the evaluation boards and the chips for final prototype.
- Most major parts are made by TI
- Other minor components like the circuit board, resistors, et al. can be fit it well with-in the allocated money!



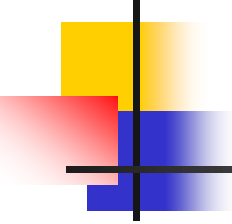
Conclusion

- Design and development of a deeply embedded PoE gateway to low power ZigBee devices
- Project can expand functionality and range by adding other RF forms such as Bluetooth
- Wireless sensor retrieval and communication via gateway connected to LAN or Internet
- Web server will communicate with MCU for easy management locally or remotely

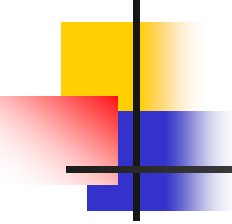


Conclusion

- PoE can be used in various ways, including the case where AC power is inconvenient or unfeasible
- Core components are cheap!
- Programming will be done exclusively with Luminary Micro's StellarisWare



Questions?



Thank You!
