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Wireless Temperature and Pressure Sensors for STERIS Controller

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Outline

- Problems & Objectives
- Design Concept
- Wireless Technologies
- Deliverables
- Budget
- Professional Awareness
- Timeline

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Problems & Objectives

- Create wireless sensor solution
- Steam sterilization units
- Large metal chambers that involve wiring of:
  - Sensors
  - PC Board
  - User Interface
  - Safeties Interlocks
- Installation hassle and cost
- Limited scalability
- Wires touching hot surfaces

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Design Concept

- Wireless Technologies
  - IEEE 802.15.4 protocol - Low data rate wireless personal area networks (WPAN)
  - ZigBee or low power star networks
  - 2.4Ghz vs Sub 1Ghz (915Mhz) frequencies
- Sensor Interface
  - Analog to digital circuit
  - Resistance Temperature Detectors (RTD) → 0-10Volts
  - Pressure Transducer (PT) → 4-20mA
- RS-485 Ethernet Communications
- Software Development

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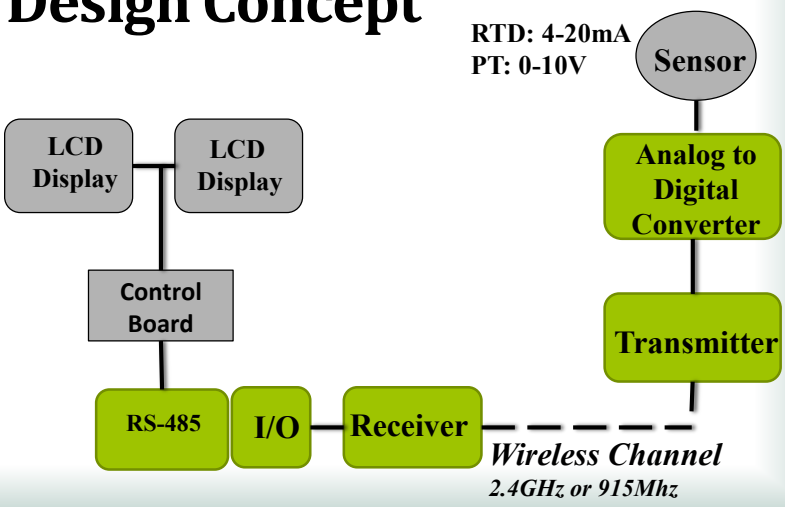
Design Concept



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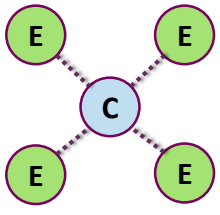
Wireless Technologies

- Star Network
  - 2.4GHz @ 250Kbps
  - One coordinator and multiple end nodes
- Sub GHz technologies
  - 915Mhz low power star networks
- Transmission Power
- Reliability
- Low Interference
  - Separate Personal Area Network (PAN) ID for each network



E - End Node
C - Coordinator

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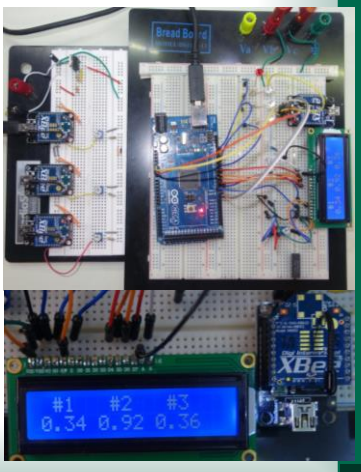
Wireless Technologies

- Xbee and Arduino
  - Proof of concept
  - Transmit voltage at Xbee A/D input
    - 0-1.2 Volts
  - 3 end nodes & 1 coordinator
- Provides understanding of RF transmission



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Deliverables

- 2.4GHz or Sub GHz (915Mhz) star network system
- 10 bit or more A/D
- 24VDC plug in power supply
  - Possibility of future cordless power solutions
- ARM Cortex micro-processor options
  - Mbed enabled board
  - Platform based off Atmel SAM D21 evaluation kit
- Common board for different types of sensors
- PCB design and working device
- Software interface with main controller

mbed Enabled

Atmel

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Budget

Xbee XB24CZ7UIS-004	Atmel ATZB-RF-233-1-C-ND
$ 17.50 per board	$29.62 per board

Estimates of other Expenses (Excluding Manufacturing)

ARM Cortex Processor	$2-4 per board
Misc. electronic components	$10-20 per board
PCB Blanks	$15-25 per board
Wireless Module	$17.50 – 29.62 per board
Total Per Completed Board	**$44.50 – 78.62 per board**

*** All prices estimated from www.Digikey.com***

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Professional Awareness

- Responsibility to make product secure
  - Ensure privacy of STERIS information
  - Prevent solution from being abused as backdoor to access STERIS client (e.g., hospitals, research centers) networks
- Develop solution that embodies the best choice based on facts and test results, and not the one most in favor
  - Prioritize security
  - Prioritize safety
- Understand the end goal and purpose
- Realize the future potential of wireless sensor applications within STERIS

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Timeline

TASK	DURATION	WHO
TEAM BUILDING		
Interview with STERIS	1d	ALL
Meeting Time and	1d	ALL
Select group leader	1d	ALL
Tasks Assignment		ALL
Sign Contract with STERIS		ALL
RESEARCH STRATEGY		
2.4Ghz vs 915 MHz testing		AG, NY, AMF
Research protocols		AA, AMF
Hardware design		AA, AG
Sensor integration		AG
Software implementation		AMF, NY
PROTOTYPE		
Order parts		AA, AG
Assemble		AA, AG
Test		AMF, AG
Alpha prototype complete		ALL
Client Reaction		AA, NY
Refactor, Beta product		ALL
REPORT		
Midterm presentation		ALL
Proposal		ALL
Final Report		ALL