Smartphone Control of Advanced Sensor Systems

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Company Contact:  
Christopher D. Ball, PhD
Team Eight

- Michael Allon – Introduction/Background
- Steve Hilton – Hardware
- Micah Zastrow - Software
- Donghun “Hun” Ha – Risks and Project Schedule
- Paul Krutty – Budget and Wrap-up
• Wireless communication between a smart phone and sensors.
Requirements

- Wireless communication with four or more sensors
- Cannot use existing communication networks
- Mobility
- Simple, user friendly interface
Problems?
- Unable to interface transceiver and I/O expansion board
- Incompatibilities between transceiver and dsPIC33E
Spring 2012 Design

ANDROID NODE (x1)
SENSOR NODE (x4)

PIC24FJ256GB110
PIM

MRF49XA

EXPLORER 16 BOARD

USB PICTAIL+
Explorer 16 Development Board

- Powered by 9VDC supply.
- 100-pin PIM riser
- Push button switches (needed for Sensor nodes)
- Comes with dsPIC33F processor module:
  - 16-bit Architecture
  - 30kB RAM
  - 85 I/O PINS.
- Similar to last year’s design – allows for use of code as guide.
MRF49XA Transceiver

- Communication without use of existing networks (e.g. WiFi, Cellular)
- Using a MiWi Network (low-power/low-data rate)
- Range of ~300 meters.
- Power-saving modes
- Operating Voltage: 2.2V-3.8V
- Low-Current: 11mA/15mA for RX/TX
USB PICTAIL+ and PIC24 Processor Module

- PICTAIL+ allows USB connectivity between Explorer 16 Development Board and Smart Phone.
- This PIC24 met the minimum requirements of processor modules needed with the Explorer 16 for Android development.
- 16-bit Architecture
- 16kB RAM
- nanoWatt Power Modes
- Full speed USB operation (12 Mb/s)
Software-GUI

• Eclipse
  • Android Development Tools plugin

• Android OS
  • 2.3 gingerbread
  • Google API version 10

• Must be simple and reliable
Software-GUI (cont.)

- One main screen
- Multiple sensors on screen
  - Receive status updates
  - Low power
  - Functioning/Not Functioning
  - Dangerous chemicals
- Connects to sensor
- Color Coded

Sensor Connected.
Warning: Battery Low!

Connected: Yes  Chemicals: Good  Battery: 10%
Android/Sensor Node Code

• MPLAB ICD 3
• Functionality:
  • Android Node
    • Receive signals from sensor node
    • Convert to digital and transmit to phone through USB
    • Receive digital signal from phone, convert and transmit to sensors
  • Sensor Nodes
    • Receive and process signals from Android node
    • Transmit signals representing the various states the actual sensor can detect
Risks & Concerns

- Channel Noise
  - testing is the KEY.
- Portable Power Sources
  - by adding secondary batteries.
- Channel Security
  - by developing encryption.
## Project Management

<table>
<thead>
<tr>
<th>Component</th>
<th>Responsible Parties</th>
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<tbody>
<tr>
<td>Android GUI</td>
<td>Micah, Paul</td>
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<tr>
<td>Android Node</td>
<td>Michael, Hun</td>
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<tr>
<td>Sensor Node</td>
<td>Michael, Hun, Steve</td>
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<tr>
<td>Mi-Wi Communication Code</td>
<td>Steve</td>
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<tr>
<td>Interface Components</td>
<td>All together</td>
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## Budget

- Paid for by Battelle

<table>
<thead>
<tr>
<th>Item</th>
<th>Quantity</th>
<th>Cost</th>
<th>Total</th>
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<td>MRF49XA RF Transceivers</td>
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<td><strong>Total:</strong></td>
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• **Ece budget - $500**

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<td>Samsung Nexus S Smartphone</td>
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</table>

• **Incidentals/Unforeseen - $170**
In Conclusion

• Requirements
  • Wireless communication with four or more sensors
  • Cannot use existing communication networks
  • Mobility
  • Simple, user friendly interface

• Solution:
  • GUI – Android OS
  • Explorer 16 board – base for android and sensor nodes
  • USB Pictail attachment to connect to phone
  • MiWi RF Transceivers for communication
Questions?