

# Prototyping Physical User Interfaces

Short Course @



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## Brief Course Outline

- Breaking Interface Conventions?
- Exercise – creating a cooperative multi user game
- Nature and Value of Physical Prototyping
- Break
- Smart-its basics
- Smart-its enhanced light
- Lunch break
- Students project (afternoon)  
Smart-its enhanced light
- Smart-its enhanced light – results
- Building Smart-its hardware
- Break
- Developing Smart-its Software
- Smart-its Examples
- Wrap-Up

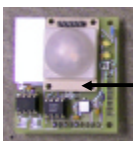
## Smart-Its Basics

## Smart-Its

- Why a toolbox and not a device or system?
- Physical prototypes have things in common
  - processing
  - communication
  - Requirements on debugging I/O
- ... but there are differences in
  - Sensing
  - Actuators
- This is reflected in Smart-Its...

## Smart-Its System Setups (1)

- Smart-Its single device
  - Smart-it is wired (serial line) to another device (e.g. PC or PDA)
  - Acts as sensor and/or actuator

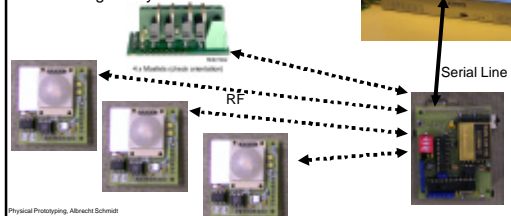


Serial Line

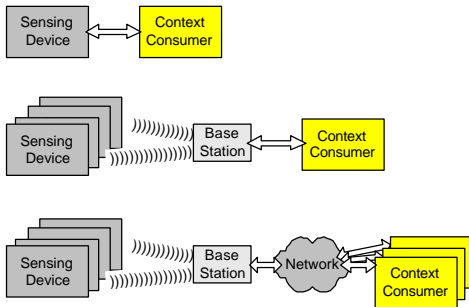


## Smart-Its System Setups (2)

- Smart-Its system
  - Smart-It as wireless receiver/gateway attached to another device (e.g. PC or PDA)
  - Wireless sensors communicating with the receiver
  - Wireless actuators communicating with the gateway and/or wireless sensors



## Basic Architectures



## Smart-Its Device Setup

- Device consists of a core and optionally a AddOn component
- Core
  - processing
  - Wireless and wired communication
  - debugging I/O
- AddOn
  - Sensors
  - Actuators
  - Memory
  - Other forms of communication

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## Smart-Its Platform



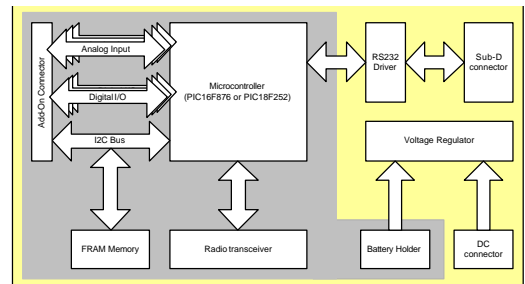
### All core boards

- Microcontroller
- RAM
- Analog Inputs
- Digital I/O
- Wireless communication
- All boards are software and hardware compatible

- Small portable unit
  - 45mm x 50mm x 19mm
  - 29g with battery
- Base station and debug unit
  - 55mm x 70mm x 29mm
  - 110g with 4x AAA
  - RS232 connector
  - DC Power Connector

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## Hardware Core Board Basics



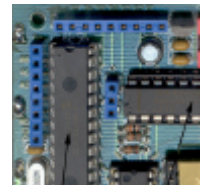
## Design Choices Explained

- Target group – students and researchers
- Technical/conceptual
  - Simple RF system
  - PIC microcontroller
  - F-RAM
  - No in-circuit programming
  - No SMD – conventional components
  - No USB - Serial line
  - Standard batteries / rechargeable
  - DIY (self-soldering) approach

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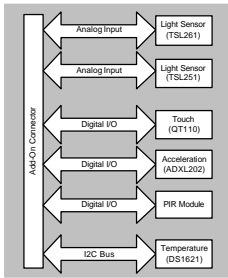
## AddOn Connector

- Mechanical function
  - Hold the AddOn board
- Electronics
  - Provide
    - Power and GND
    - 5 Analog IN
    - 7 Digital I/O
    - I2C bus



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## Hardware Sensor Board Basics



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## Debugging

### At Pain...

- Can be hardware, communication, system software, or application software

### Had influence on design choices...

- Change configuration (by physically moving processor and FRAM)
- Debugging is easier that way!

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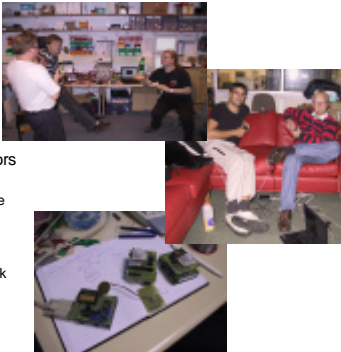
## Platform Evaluation Prototyping Exercise I

### Evaluation Method

- Developers Workshop (DC Atelier)
- 2,5 days hands-on

### Results

- Prototypes & Demonstrators
  - Smart Ball
  - Wireless Gesture Remote Control
  - Singing Smart-It
  - Wireless RFId Sensor
  - Wireless Gesture Joystick
- Value of implementation



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## Prototyping Exercise - Impressions



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