Prototyping in Physical Computing – Sketching in Hardware

Medieninformatik Hauptseminar Wintersemester 2009/2010 „Prototyping“
Outline

1. Hardware Prototyping: An Introduction
2. Available Toolkits: My Seven Picks
3. Classification: High Level vs. Low Level
4. Project Examples
5. Conclusion and Outlook
1. Introduction
The Major Trends in Computing

- Mainframe (one computer, many people)
- PC (one person, one computer)
- Ubiquitous Computing (one person, many computers)
2. Hardware Toolkits

Seven Picks:
- Arduino
- BASIC Stamps
- littleBits
- Electronic Brick
- Phidgets
- LEGO Mindstorms
- The BUG
Arduino

- Minicomputer
- Many different versions
- Open Hardware
- Open Software
- Assembler programmable
- C / C++ programmable
BASIC Stamps

- Tiny computer modules
- Programmable in BASIC
- I/O slots for communication
- Socket Connections to Flash, Max/MSP
- Various different manufacturers
littleBits

- Preassembled components
- Connected via magnets
- 4 groups: Power supply, Wire bits, Input & Output bits
- Open Source
- Still to be fully released
Electronic Bricks

- Extensive framework of low-level modules
- Central MCU unit
- Connected through 3 or 8 wire bus cables
- Can be used with Arduino boards
- Assembler, C/C++
Phidgets

- Research background, now commercially available
- Extensive framework
- Plug and Play modules
- C, COM, Java, .NET, Flash
- Connection to host computer necessary
LEGO Mindstorms

- Children‘s toys
- Offers all neccessarities a hardware toolkit asks for
- Various in- and output modules
- Programmable via graphical interface
- USB / Bluetooth connectors
The BUG

- Modular widget tool
- Base module, attachable in- and output elements
- Programmable in Java
- Accessable via USB, Bluetooth, Ethernet
- Modules like touch-display, camera, GPS Locator
3. Classification: High Level vs. Low Level
Classification and Examples

Hardware Complexity

<table>
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Software Complexity
High Level: The BUG
High Level: The BUG

Bug Labs buildable electronics at CES 2009
Classification and Examples

Hardware Complexity

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Mid Level: Phidgets
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Wintersemester 2009/2010
„Prototyping“
Power supply.

USB cable connected to the computer.

The servo motor controlling mole 1 and 2 is connected to port 2.

The servo motor controlling mole 3 and 4 is connected to port 1.
Classification and Examples

Hardware Complexity

Software Complexity

Arduino
BASIC Stamps

Phidgets
Electronic Brick

littleBits
The BUG

LEGO Mindstorms
Low Level: littleBits
Low Level: littleBits

http://vimeo.com/1391017
Classification and Examples

- Arduino
- BASIC Stamps
- Phidgets
- Electronic Brick
- littleBits
- The BUG
- LEGO Mindstorms

Hardware Complexity vs. Software Complexity
Conclusion and Outlook

- Huge Variety
- Online Communities
- Software Skills become focus
- No borders

A more empirical study would be very interesting to get a more powerful comparison.
Thank you for listening.

Questions?