

Research visit in Canada

Prototyping Physical User Interfaces

Project at the GroupLab (University of Calgary)
Nicolai Marquardt

Outline

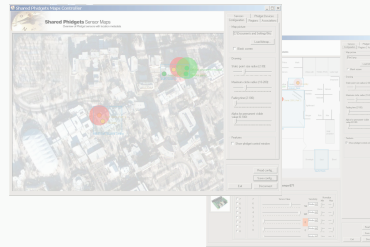
1

Introduction,
Grouplab



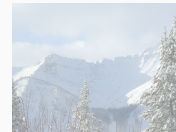
2

Project:
Physical
User Interfaces

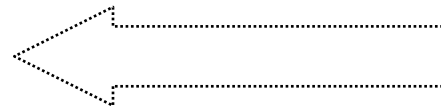


3

Canada



Research Visit

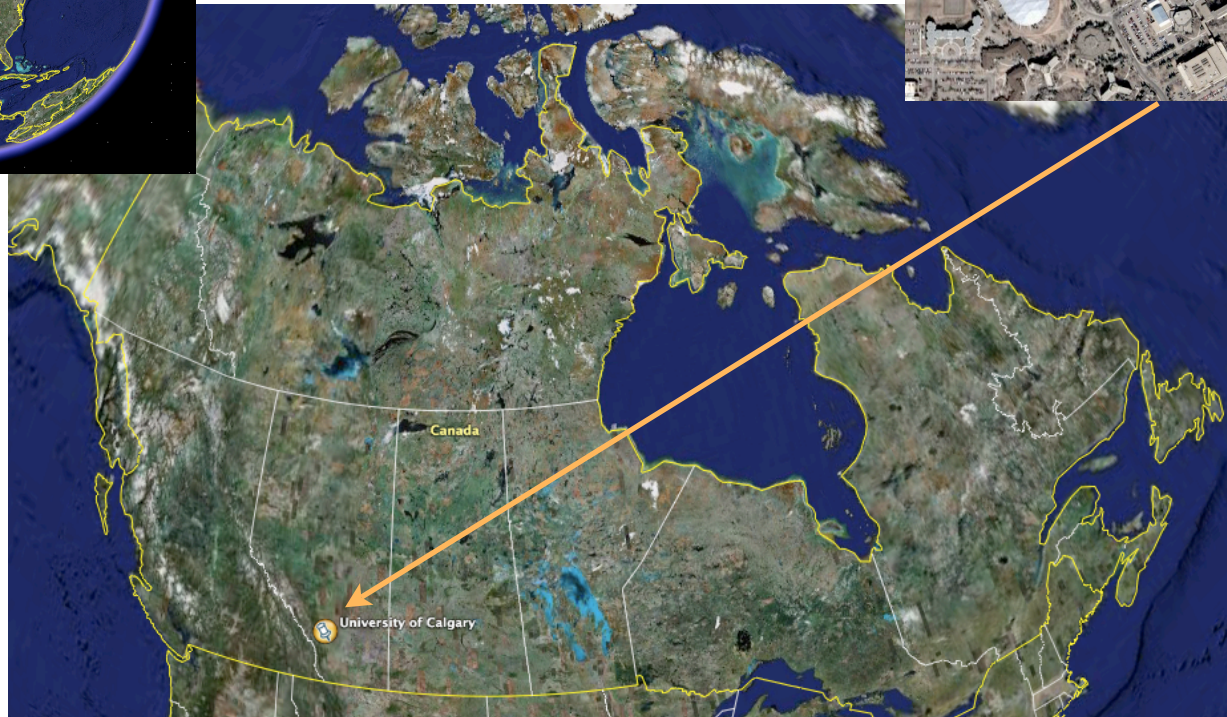


Interactions Lab, GroupLab
Prof. Saul Greenberg



CML - Cooperative Media Lab
Prof. Tom Gross

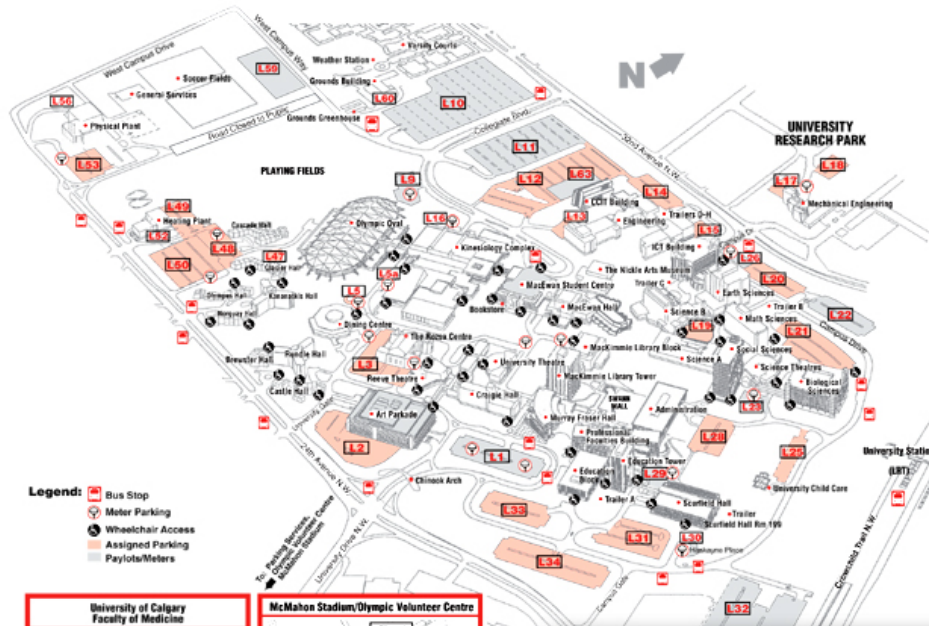
Where?



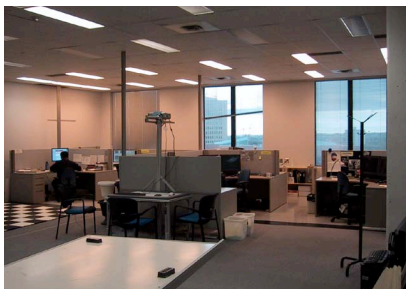
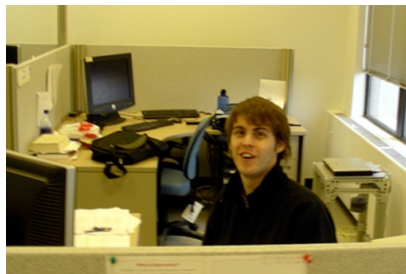
University of Calgary



UNIVERSITY OF CALGARY



Interactions Lab

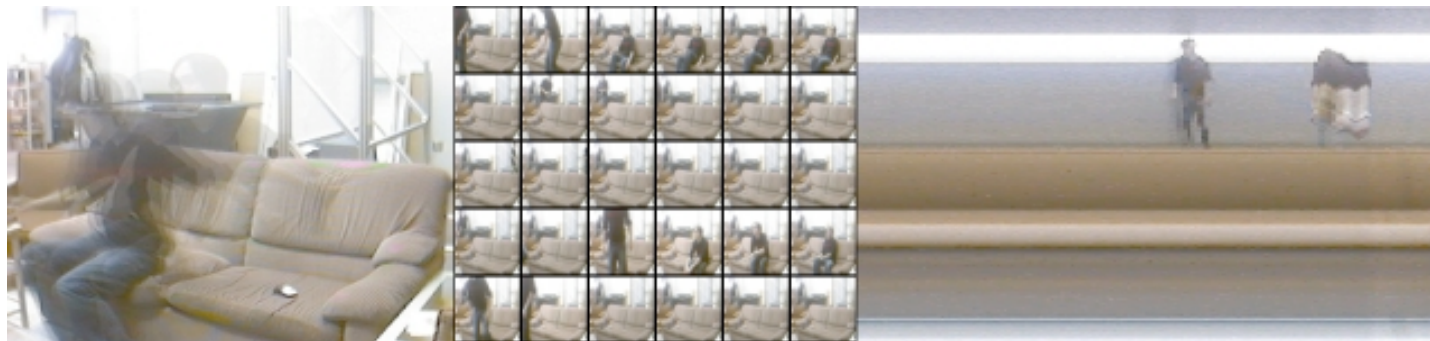
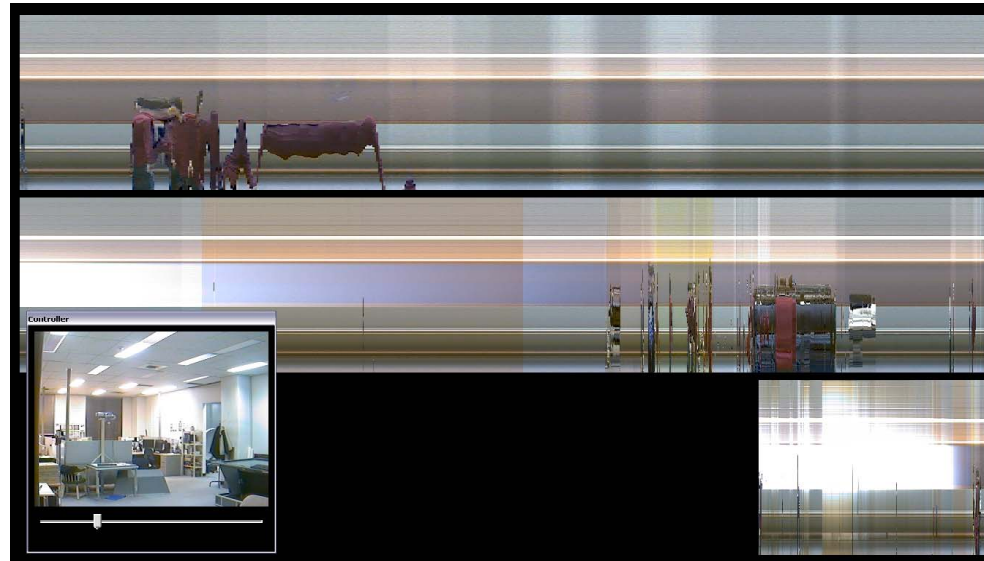


- HCI
- CSCW
- Visualization
- Computer Graphics
- Robotics

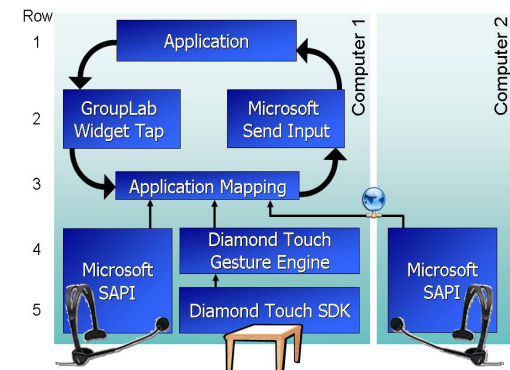
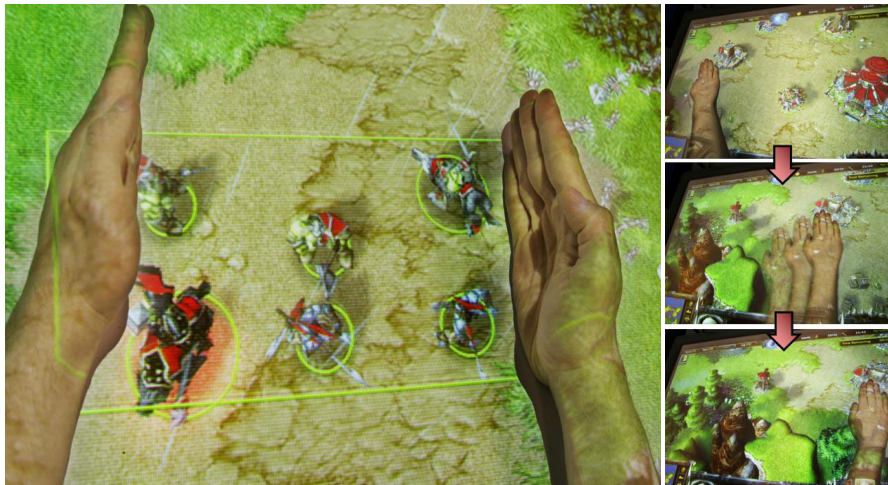
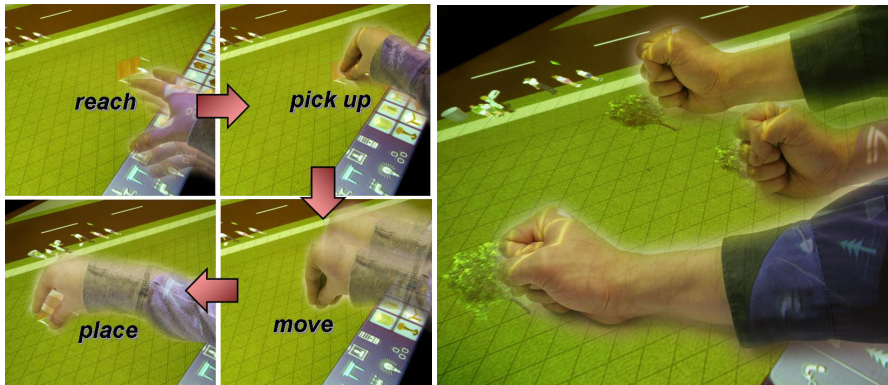


Visual Traces

Nunes, M., Greenberg, S., Carpendale, S. and Gutwin, C. (2006)
Video traces. In Karahalios, K. and Viegas, F. (Eds) ACM CHI 2006 Workshop on Social
Visualization: Exploring Text, Audio, and Video Interactions. April 22-27.



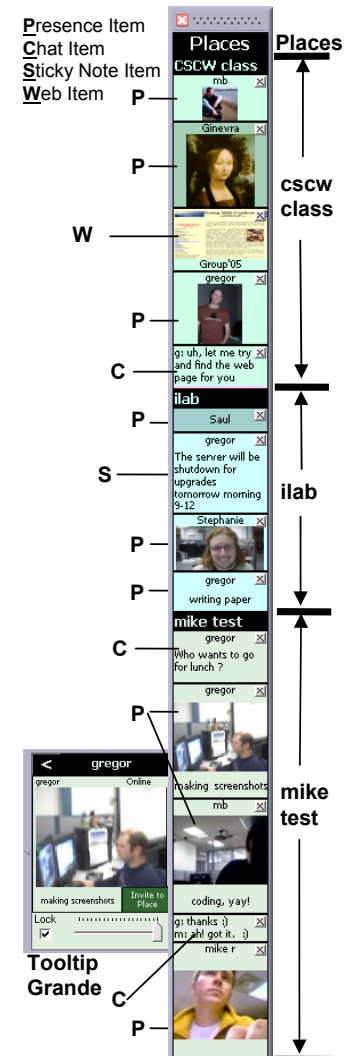
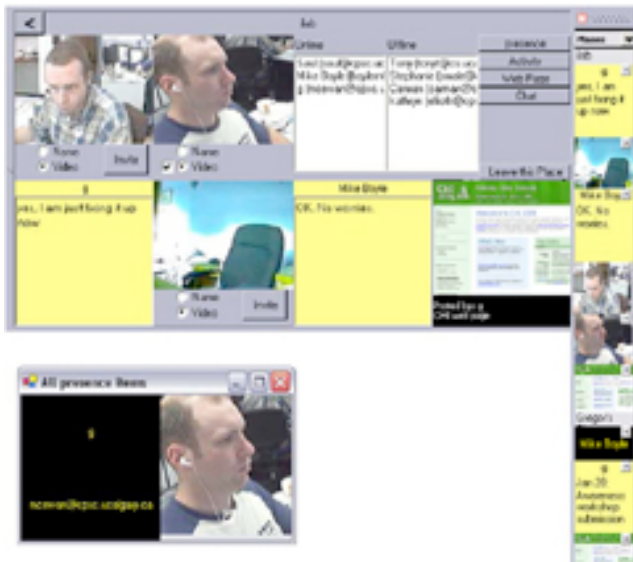
Multimodal Tabletop Interaction



Tse, E., Greenberg, S., Shen, C. and Forlines, C. (2006)
 Multimodal Multiplayer Tabletop Gaming. Proceedings Third International Workshop on Pervasive Gaming Applications (PerGames'06), in conjunction with 4th Intl. Conference on Pervasive Computing, May 7th Dublin, Ireland.

Tse, E., Shen, C., Greenberg, S. and Forlines, C. (2006)
 Enabling Interaction with Single User Applications through Speech and Gestures on a Multi-User Tabletop. Proceedings of Advanced Visual Interfaces (AVI'06), May 23-26, Venezia, Italy, ACM Press.

Community Bar



McEwan, G. and Greenberg, S. (2005)
Community Bar Places for Collaboration. In Luigina Ciolfi, Geraldine Fitzpatrick and Liam Bannon (Eds) Workshop Proceedings Settings for Collaboration: The Role of Place", held in conjunction with ECSCW'2005, Sept 18, Paris.

McEwan, G., and Greenberg, S. (2005)
Supporting Social Worlds with the Community Bar. Proceedings of the ACM Group 2005 Conference, (Nov 6-9, Sanibel Island, Florida), ACM Press.

Human-Robot Interaction



Young, J., McEwan, G., Greenberg, S. and Sharlin, E. (2006)
 Moving a Media Space into the Real World through Group-Robot Interaction. Report 2006-827-20.
 Department of Computer Science, University of Calgary, Calgary, Alberta, Canada, T2N 1N4. March 17th.

Large Tabletop Displays

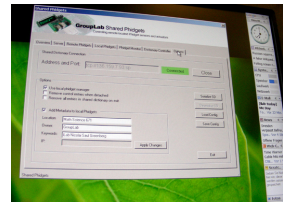
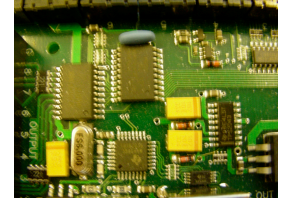


Tobias Isenberg, André Miede, and Sheelagh Carpendale (2006). [A Buffer Framework for Supporting Responsive Interaction in Information Visualization Interfaces](#). In *Proceedings of the Fourth International Conference on Creating, Connecting and Collaborating through Computing (C5 2006, January 26-27, 2006, Berkeley, California, USA)*, Los Alamitos, CA.

My Research Project



My Research Project

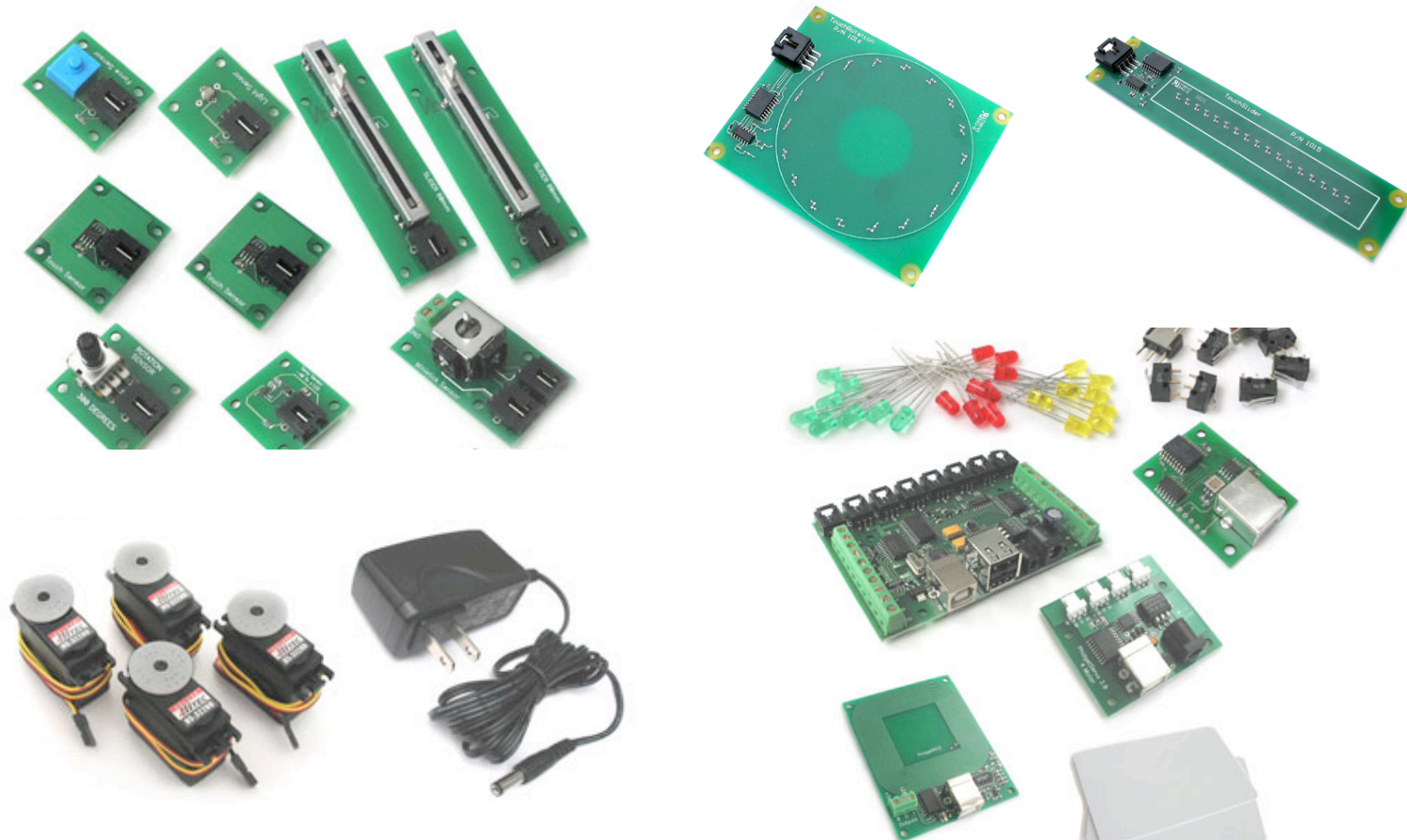


Shared Phidgets

Rapidly Prototyping
Distributed Physical User
Interfaces

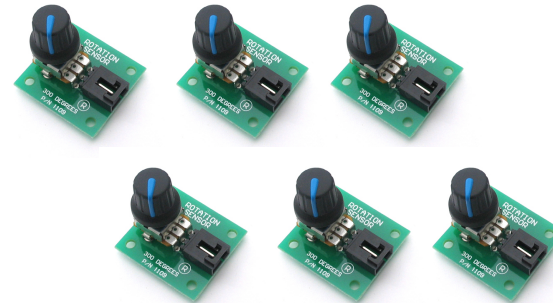
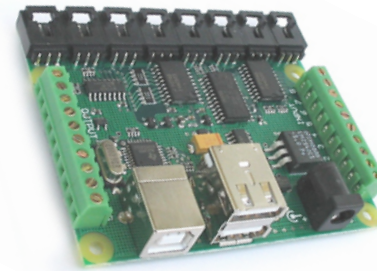
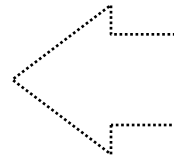
Marquardt, N. and Greenberg, S. (2006)
Shared Phidgets: A Toolkit for Rapidly Prototyping Distributed Physical User Interfaces. Report 2006-829-22,
Department of Computer Science, University of Calgary, Calgary, Alberta, Canada, T2N 1N4. April.

Physical User Interface Components



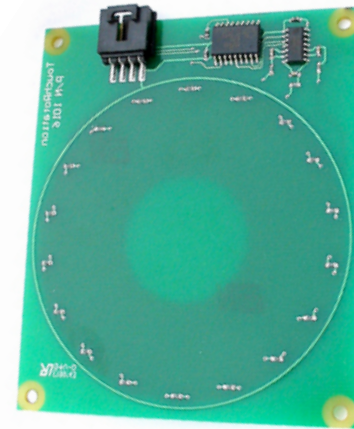
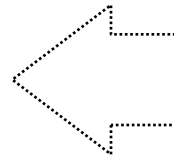
Physical User Interfaces: Example 1

Device Prototyping



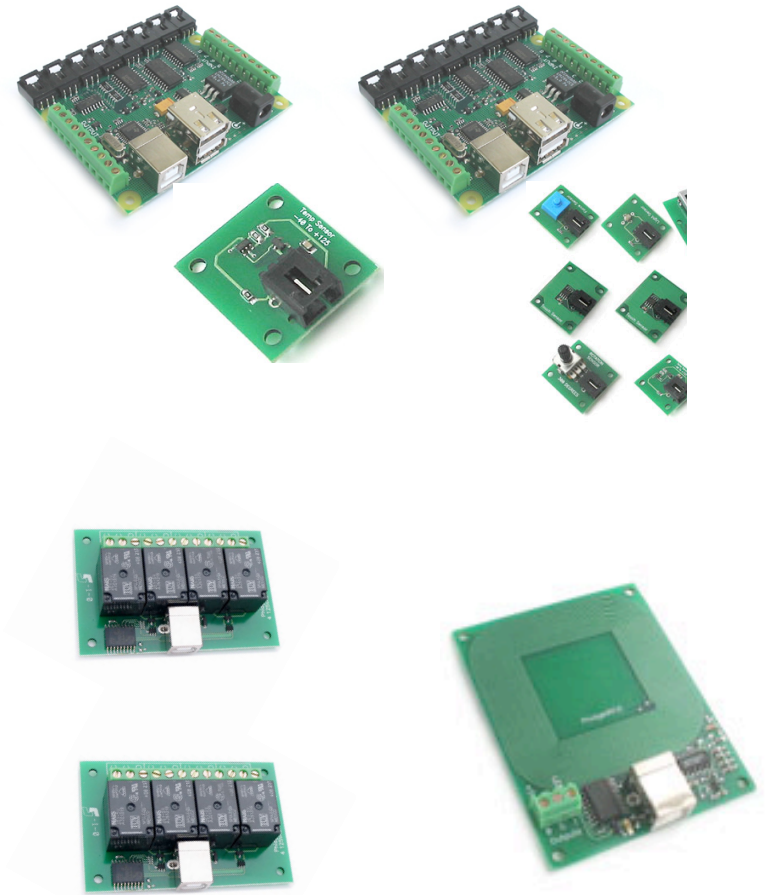
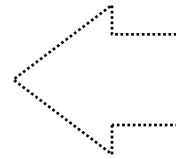
Physical User Interfaces: Example 2

Device Prototyping



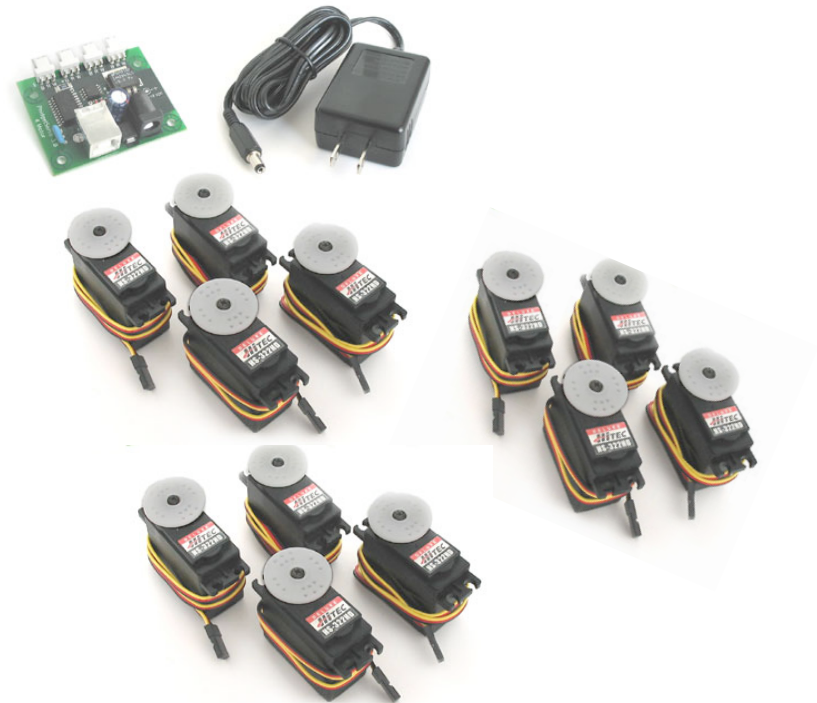
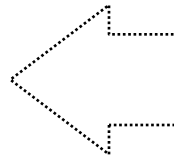
Physical User Interfaces: Example 3

Smart Home, Situated Computing



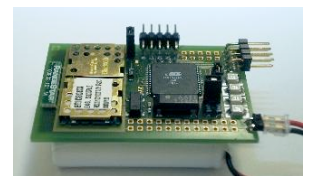
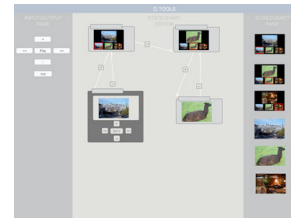
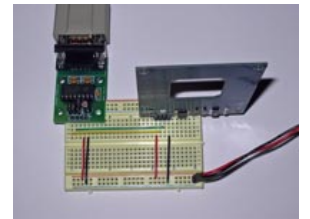
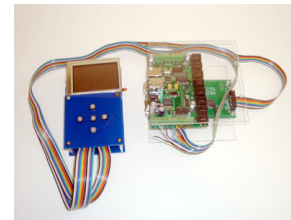
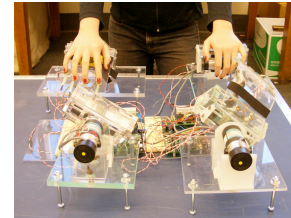
Physical User Interfaces: Example 4

Robotics



More Applications

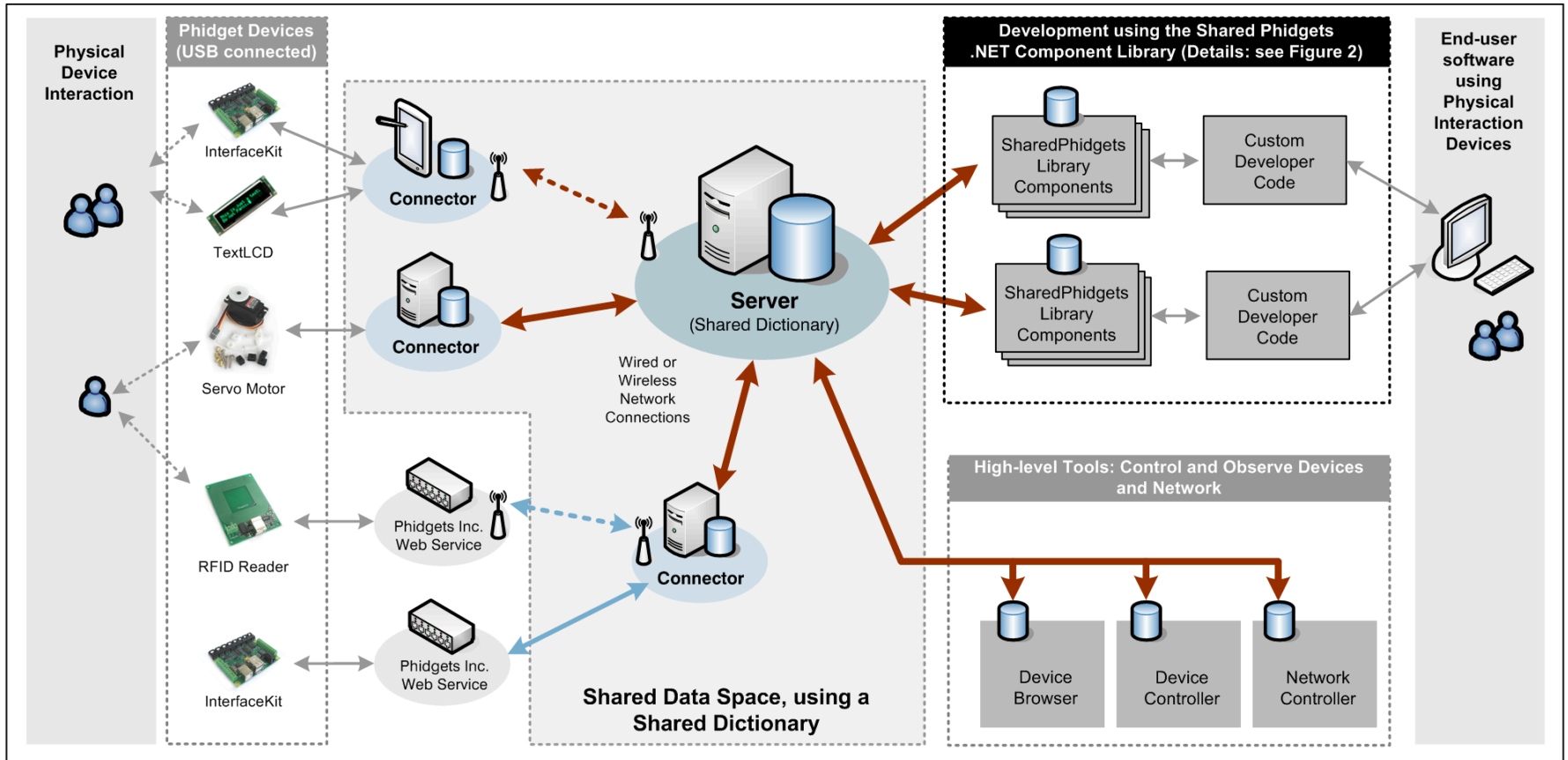
- New Interaction devices: application and game controller, etc. (MIT)
- Device prototypes: music player, game devices, etc. (Stanford)
- Situated computing: interactive calender, message systems, etc. (MSR)
- RFID technology (IBM, SAP)
- Smart and adaptive environment (CML, GroupLab, TH Karlsruhe, TU München)
- etc.



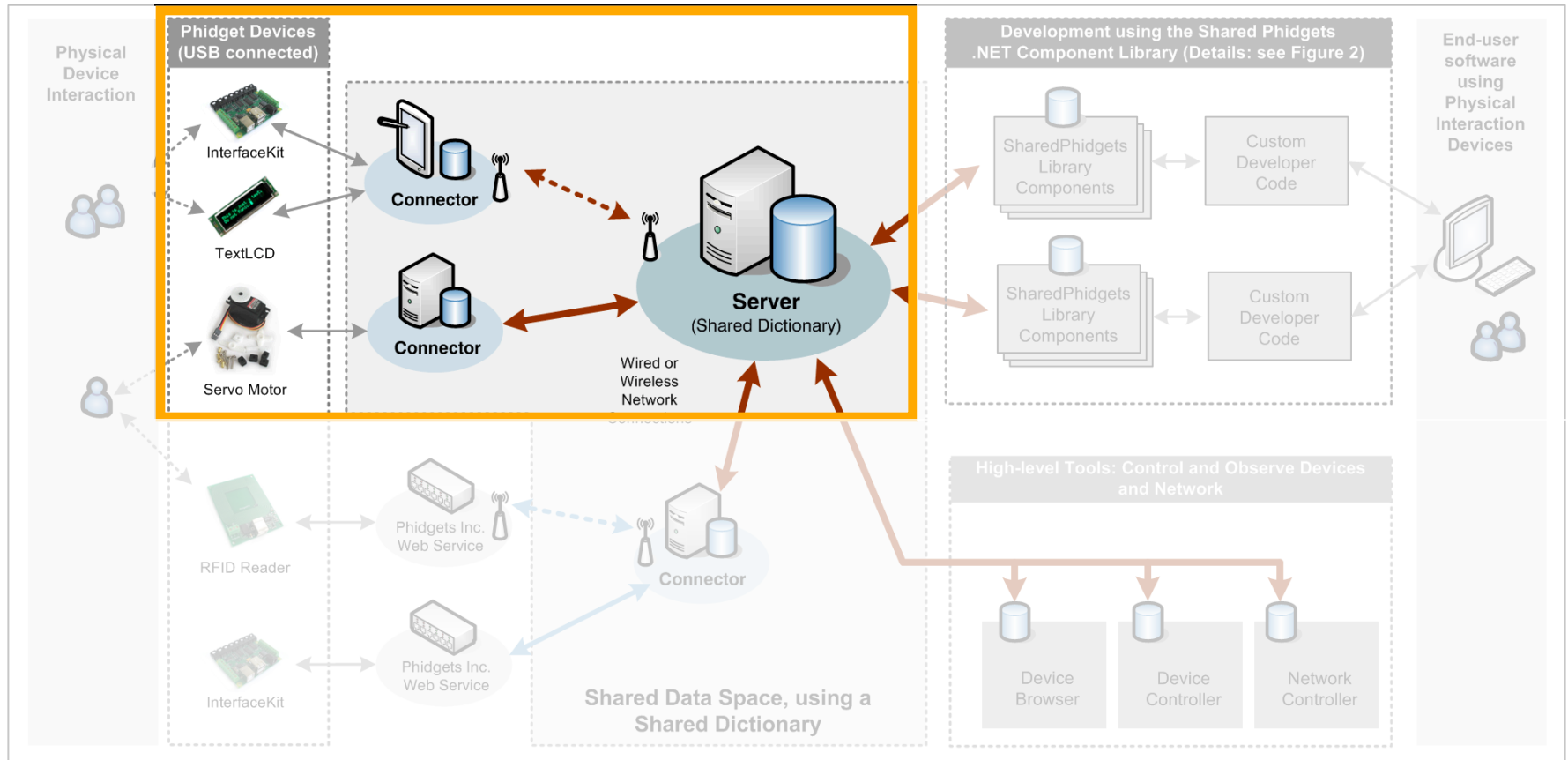
Research Project Objective

*Architecture and Toolkit for the
Rapid Prototyping of Distributed
Physical User Interfaces.*

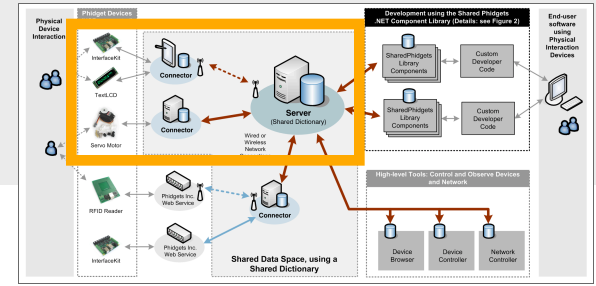
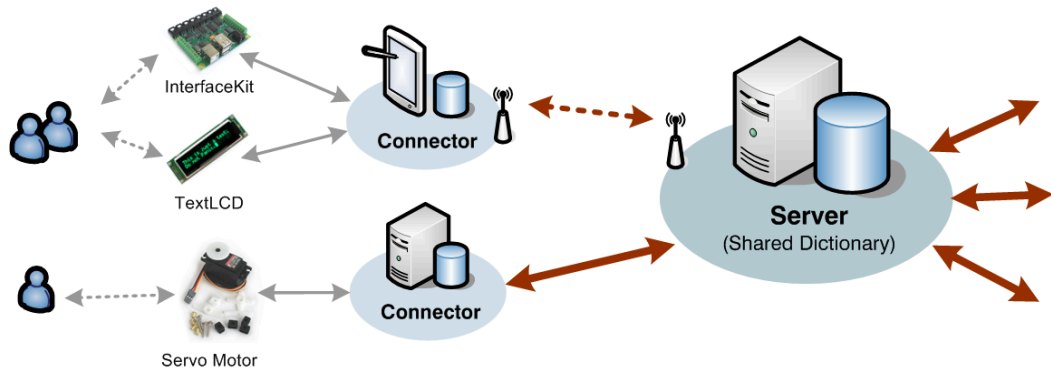
Architecture



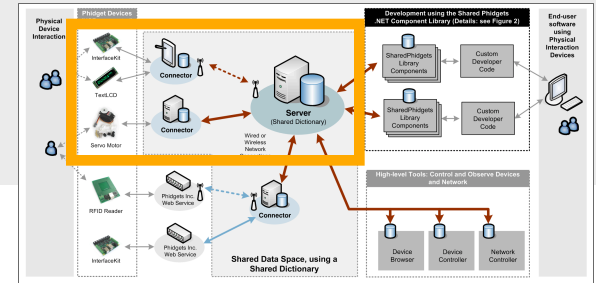
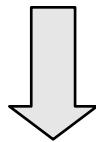
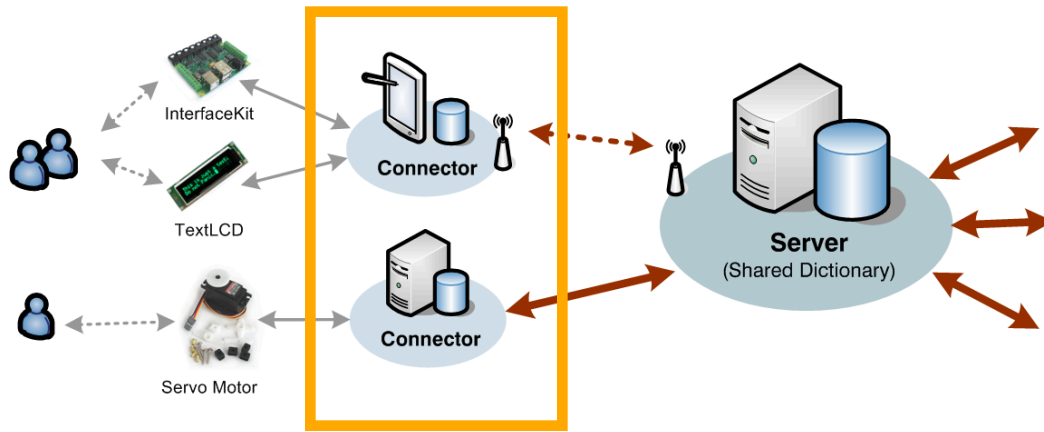
Connecting Phidgets



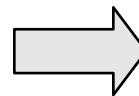
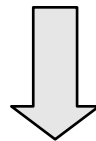
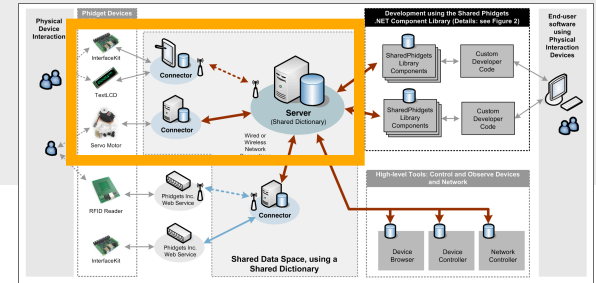
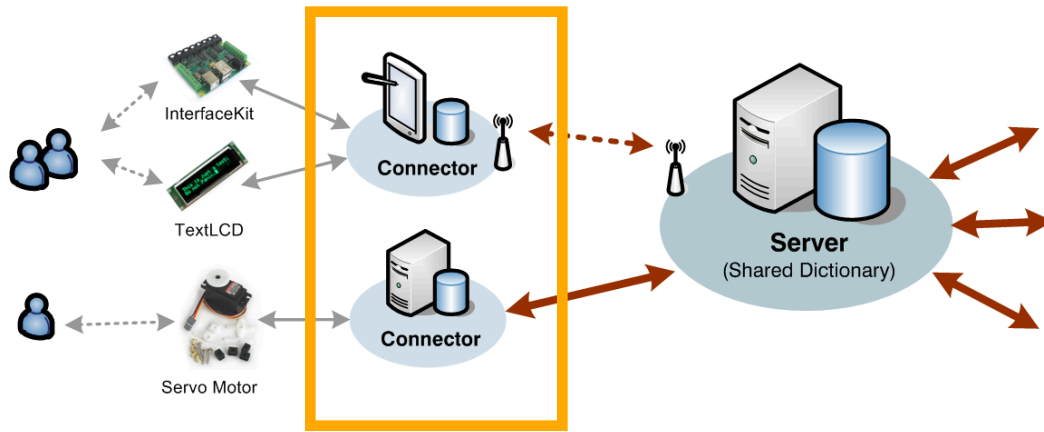
Connecting Phidgets



Connecting Phidgets

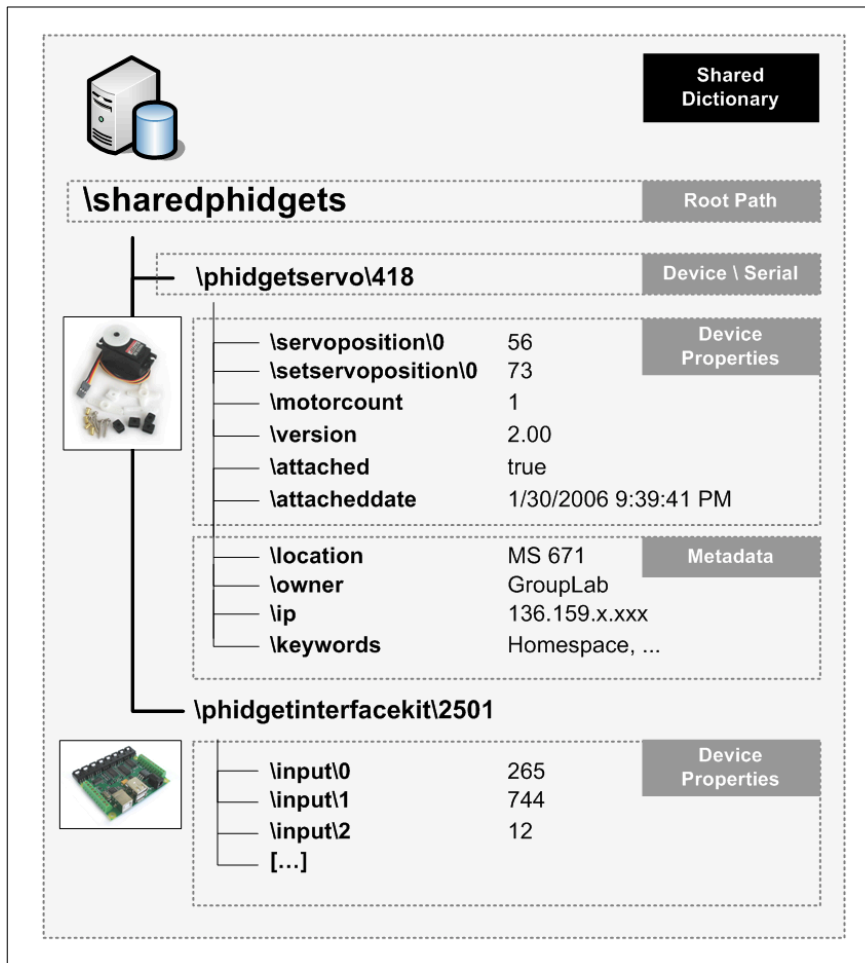
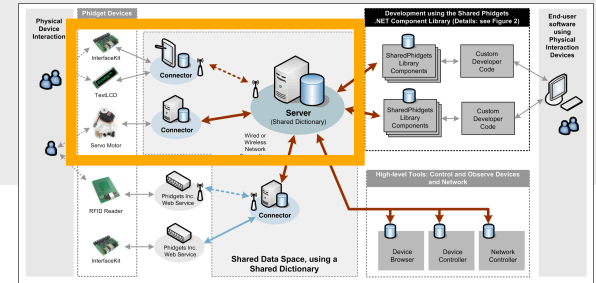


Connecting Phidgets

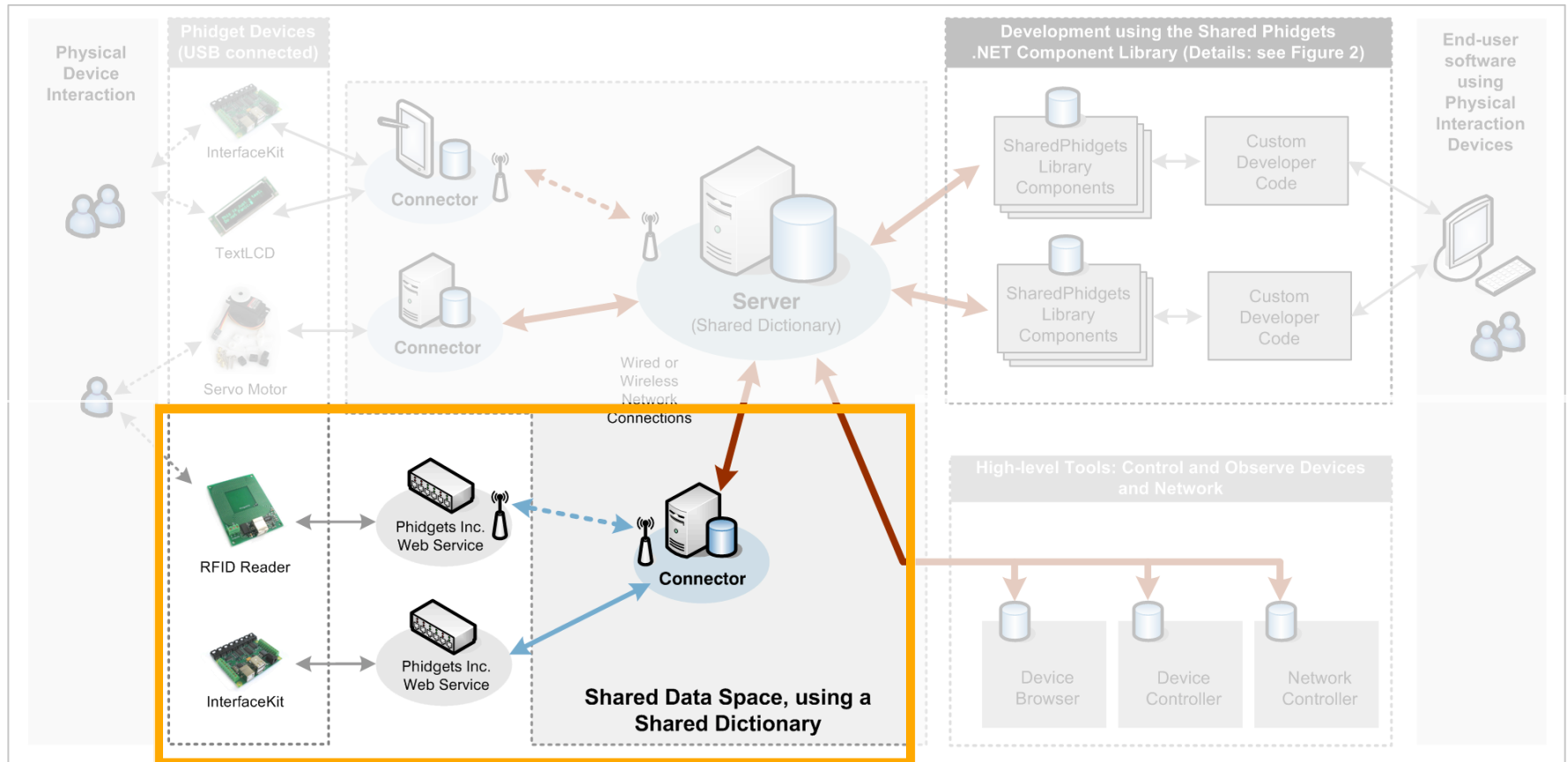


Phidget Type	Serial	Attached	Version
phidgetsno	143	True	2
phidgettextlcd	2360	True	1.11
phidgetinterfacekit	2360	True	1.11
phidgetinterfacekit	2501	True	8.11
phidgetinterfacekit	2454	True	8.11
phidgetrfid			

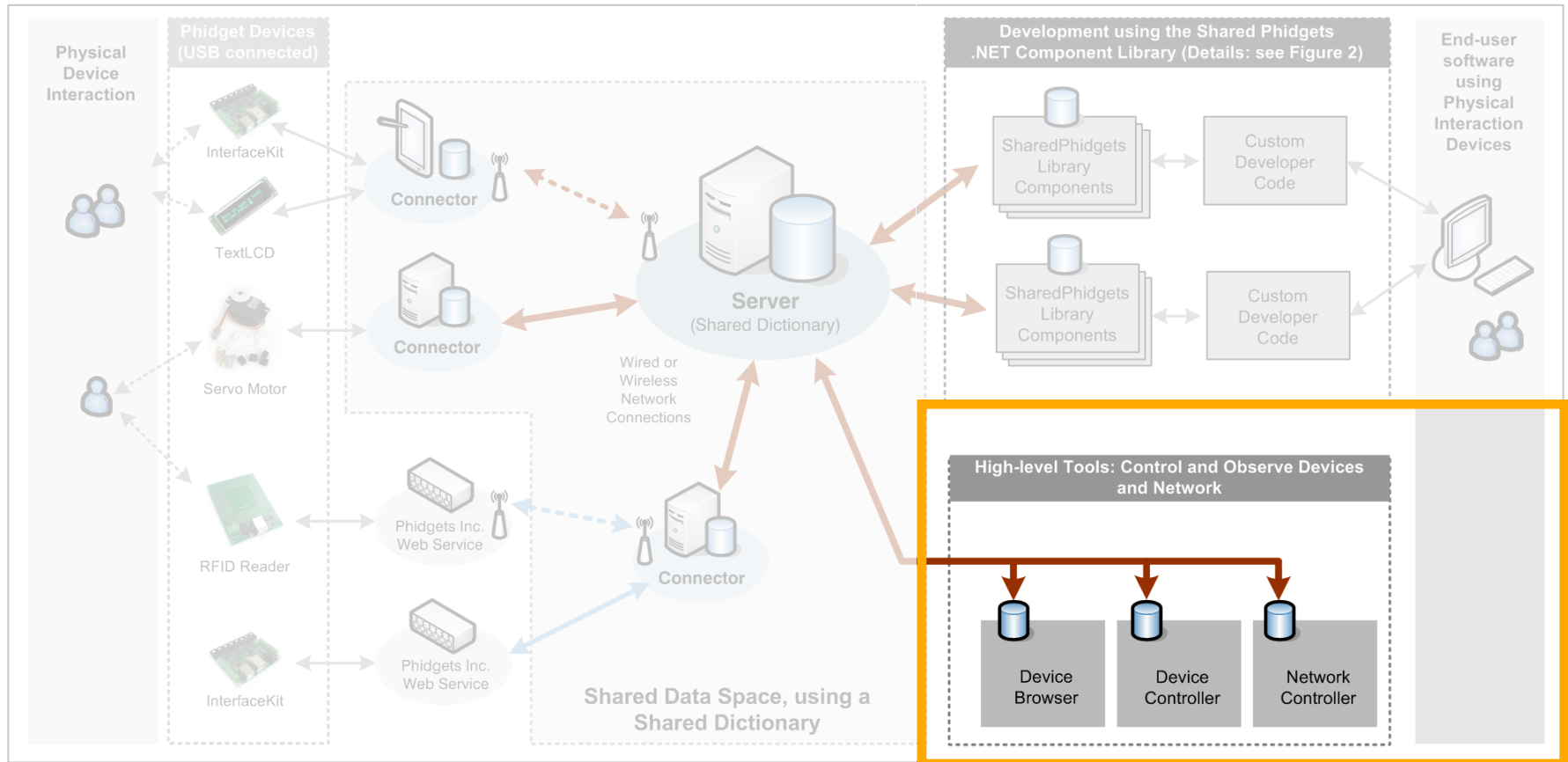
Connecting Phidgets



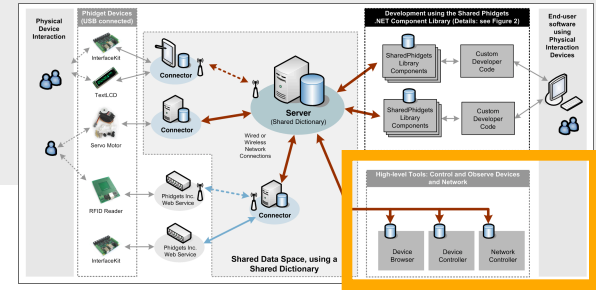
Phidgets Inc. Web Services



Observe, Control, Simulate



Observe, Control, Simulate



Shared Phidgets Controller

/sharedphidgets/phidgetinterfacekit/2501/input/1 As Filter > Connected: Client Disconnect

Path	Value
/sharedphidgets/phidgetinterfacekit/2501/keywords	iLab Nicolai Saul Greenb...
/sharedphidgets/phidgetinterfacekit/2501/input/5	False
/sharedphidgets/phidgetinterfacekit/2501/sensor/0	0
/sharedphidgets/phidgetinterfacekit/2501/input/7	False
/sharedphidgets/phidgetinterfacekit/2501/input/0	False
/sharedphidgets/phidgetinterfacekit/2501/output/2	False
/sharedphidgets/phidgetinterfacekit/2501/ip	136.159.7.93
/sharedphidgets/phidgetinterfacekit/2501/attached	False
/sharedphidgets/phidgetinterfacekit/2501/input/...	8
/sharedphidgets/phidgetinterfacekit/2501/version	8.11
/sharedphidgets/phidgetinterfacekit/2501/attach...	2/3/2006 2:40:36 PM
/sharedphidgets/phidgetinterfacekit/2501/input/6	False
/sharedphidgets/phidgetinterfacekit/2501/output/1	False
/sharedphidgets/phidgetinterfacekit/2501/input/3	False
/sharedphidgets/phidgetinterfacekit/2501/output/3	False
/sharedphidgets/phidgetinterfacekit/2501/sensor/4	3
/sharedphidgets/phidgetinterfacekit/2501/sensor/5	3
/sharedphidgets/phidgetinterfacekit/2501/sensor/6	2
/sharedphidgets/phidgetinterfacekit/2501/sensor/7	2
/sharedphidgets/phidgetinterfacekit/2501/sensor/0	516
/sharedphidgets/phidgetinterfacekit/2501/sensor/1	616
/sharedphidgets/phidgetinterfacekit/2501/sensor/2	0
/sharedphidgets/phidgetinterfacekit/2501/sensor/3	983
/sharedphidgets/phidgetinterfacekit/2501/owner	GroupLab
/sharedphidgets/phidgetinterfacekit/2501/output/4	False
/sharedphidgets/phidgetinterfacekit/2501/output/7	False
/sharedphidgets/phidgetinterfacekit/2501/output/...	8
/sharedphidgets/phidgetinterfacekit/2501/output/0	False
/sharedphidgets/phidgetinterfacekit/2501/output/0	False
/sharedphidgets/phidgetinterfacekit/2501/output/5	False
/sharedphidgets/phidgetinterfacekit/2501/output/6	False
/sharedphidgets/phidgetinterfacekit/2501/output/0	False
/sharedphidgets/phidgetinterfacekit/2501/output/2	False

View and Control Filter

Use Filter Reset

Entries

Both
 Actuator Control (changeable)
 Sensor Values and Metadata

Device Type

Phidget RFID
 Phidget Interface Kit
 Phidget Servo
 Phidget Text LCD
 Phidget Weight Sensor
 Phidget Accelerometer

Serial Number

Serial filter: 2501

7 8 9
4 5 6
1 2 3
0 Clear

Check all Check none

Exit

Connected to server: tcp://136.159.7.93:sp

View, modify, add and delete dictionary entries

Shared Phidgets Controller GUI

Phidget Manager

Device Type	Serial	Attached	Version	Location	Owner	Keywo
phidgetinterfacekit	2350	True	1.11	Math Science 671	GroupLab	iLab N
phidgetinterfacekit	2501	False	8.11	Math Science 671	GroupLab	iLab N
phidgettextlcd	2348	True	1.11	Homespace	GroupLab	Homes
phidgetinterfacekit	2348	True	1.11	Homespace	GroupLab	Homes
phidgetservo	41	True	2	Homespace	GroupLab	Homes
phidgetinterfacekit	328	True	1	Homespace	GroupLab	Homes
phidgettextlcd	2350	True	1.11	Math Science 671	GroupLab	iLab N
phidgetservo	418	False	2	Math Science 671	GroupLab	iLab N
phidgettextlcd	1558	True	1	Math Science 671	GroupLab	iLab N
phidgetid	6937	True	2	Math Science 671	GroupLab	iLab N
phidgetid	599	True	1	Homespace	GroupLab	Homes

Exit Disconnect

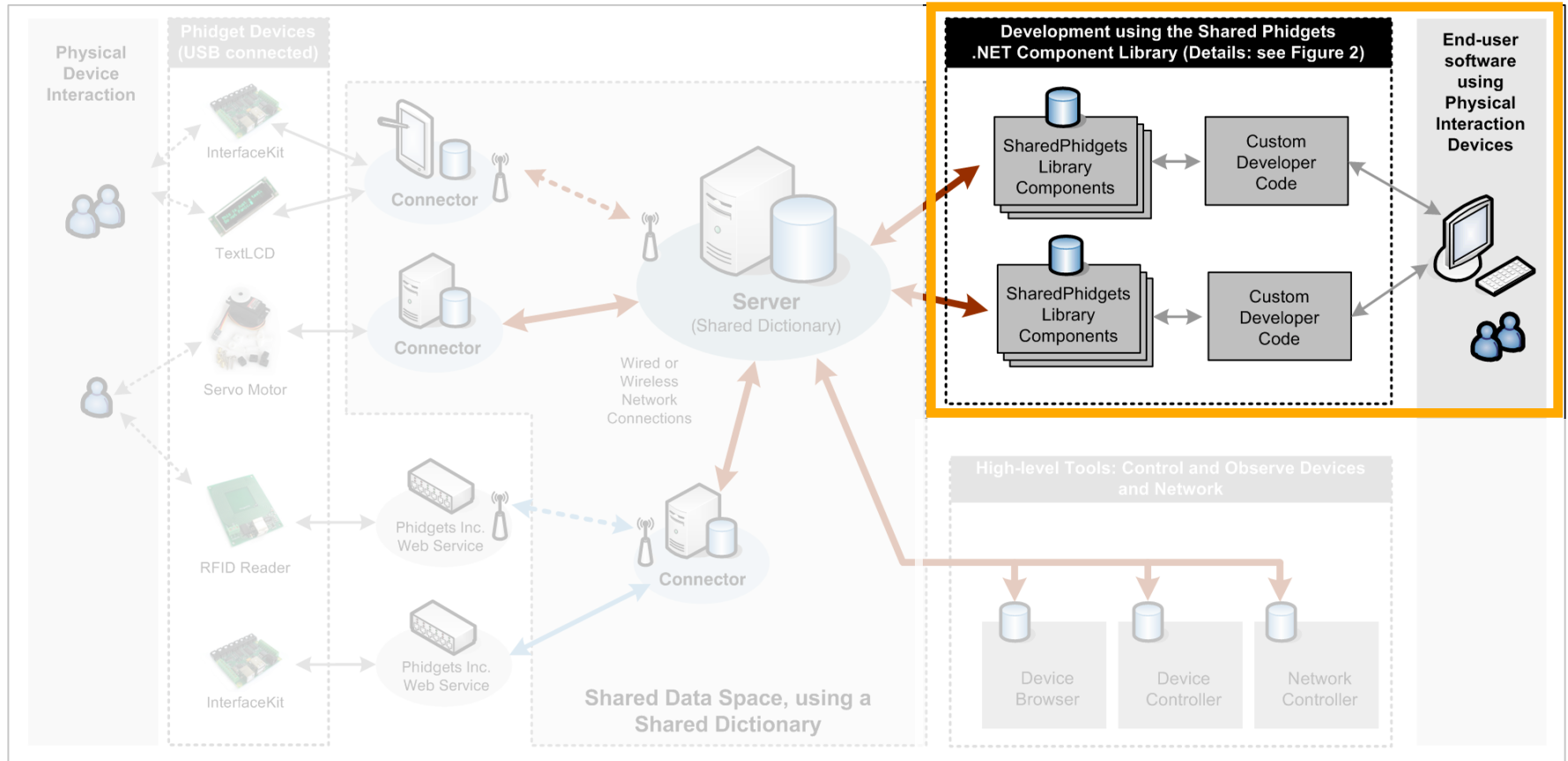
Phidget InterfaceKit, Serial: 328, Location: Homespace

Interface Kit - Serial# 328

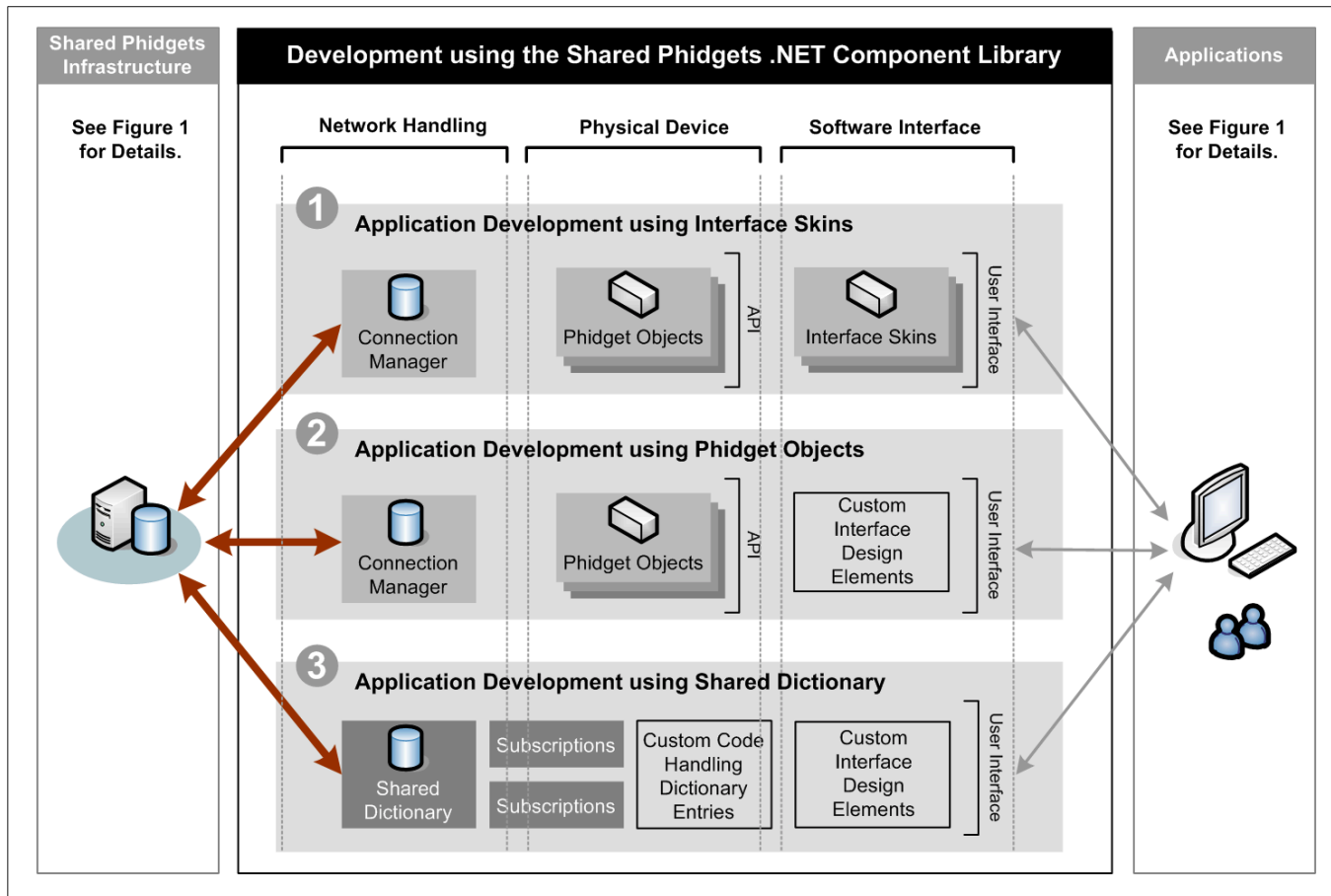
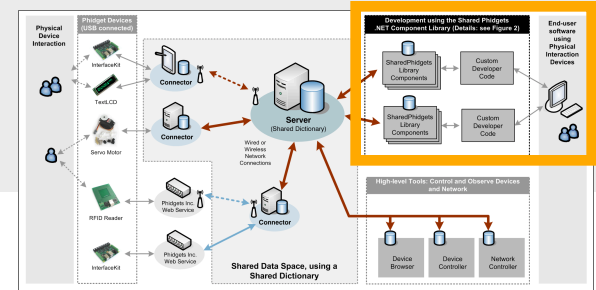
Outputs	Inputs	Sensors
<input type="checkbox"/> 7	7	Sensor Value: 472
<input type="checkbox"/> 6	6	Sensitivity: Medium
<input type="checkbox"/> 5	5	Normalize: Min
<input type="checkbox"/> 4	4	0
<input type="checkbox"/> 3	3	0
<input type="checkbox"/> 2	2	0
<input type="checkbox"/> 1	1	0
<input type="checkbox"/> 0	0	0

View and control available Phidget devices

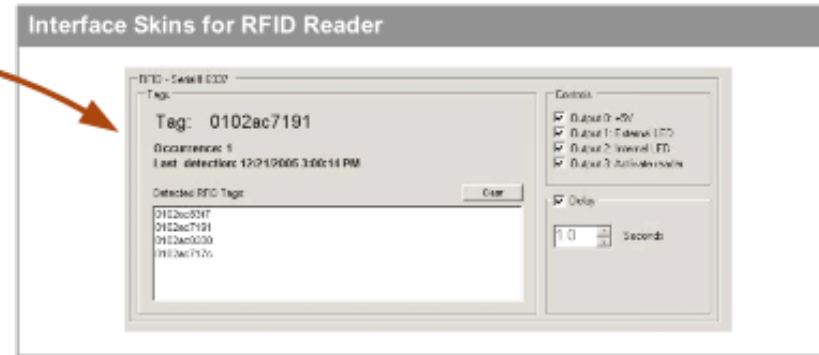
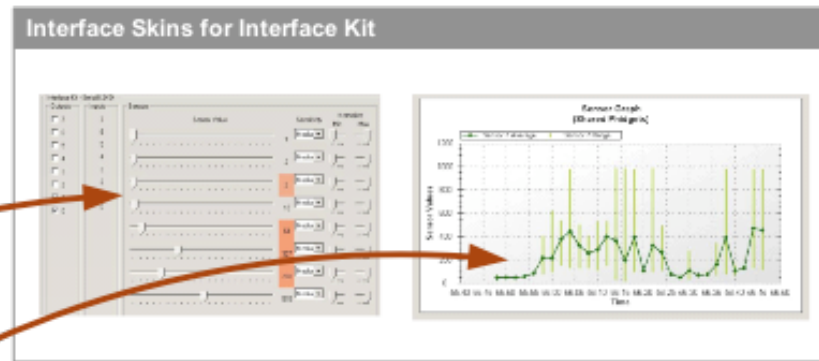
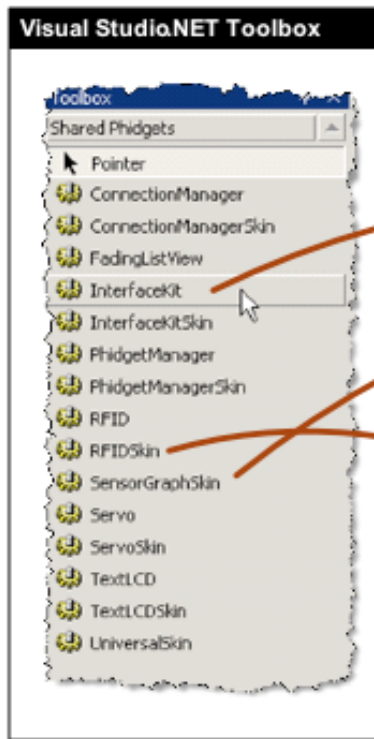
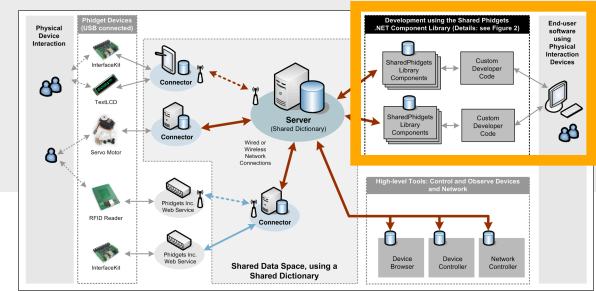
Developer Toolkit



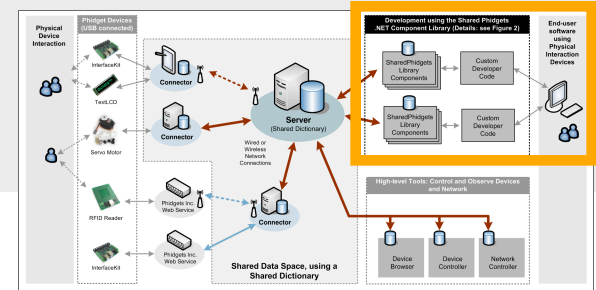
Developer Toolkit



Developer Toolkit



Developer Toolkit

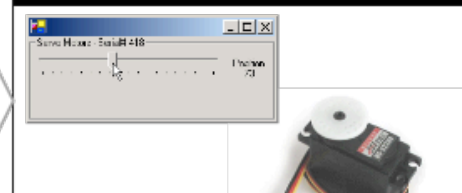


Example A: Servo Control- Using the Interface Skin

```

01. public Form1 () {
02.     ConnectionManager connectionManager new ConnectionManager();
03.     connectionManagerSharedDictionaryURL= "tcp://136.159.xx.xx:sp";
04.     Servo servo= new Servo();
05.     servo.FilterLocationsAdd("Math Science 671");
06.     ServoSkin servoSkin= new ServoSkin();
07.     servoSkin.Servo = servo;
08.     servoSkin.Dock = System.Windows.Forms.DockStyle.Fill;
09.     this.Controls.Add(servoSkin); }
    
```

Control the Servo



Example B: "Hello World" - Using the RFID and TextLCD Components

```

01. private TextLCD textLCD
02. public Form1 () {
03.     ConnectionManager connectionManager new ConnectionManager();
04.     connectionManagerSharedDictionaryURL= "tcp://136.159.xx.xx:sp";
05.     RFID rfid= new RFID();
06.     rfid.FilterSerialNumbersAdd(6937);
07.     rfid.Tag +=new RFIDTagEventHandler(rfid_Tag);
08.     this.textLCD = new TextLCD();
09.     this.textLCD.FilterSerialNumbersAdd(2350); }
10. private void rfid_Tag(object sender, RFIDTagEventArgs e) {
11.     if(e.Tag == "0102acbcf0") this.textLCD.Display = "Hello World";
12.     else this.textLCD.Display = ""; }
    
```

Correct RFID Tag → "Hello World"

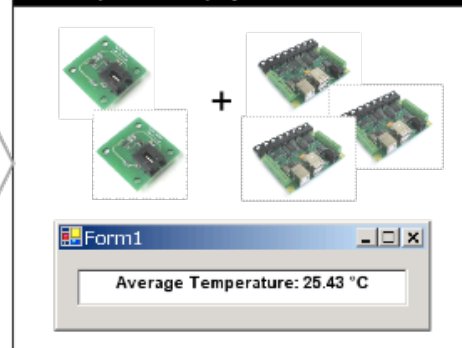


Example C: The Average Temperature- Using Only Shared Dictionary

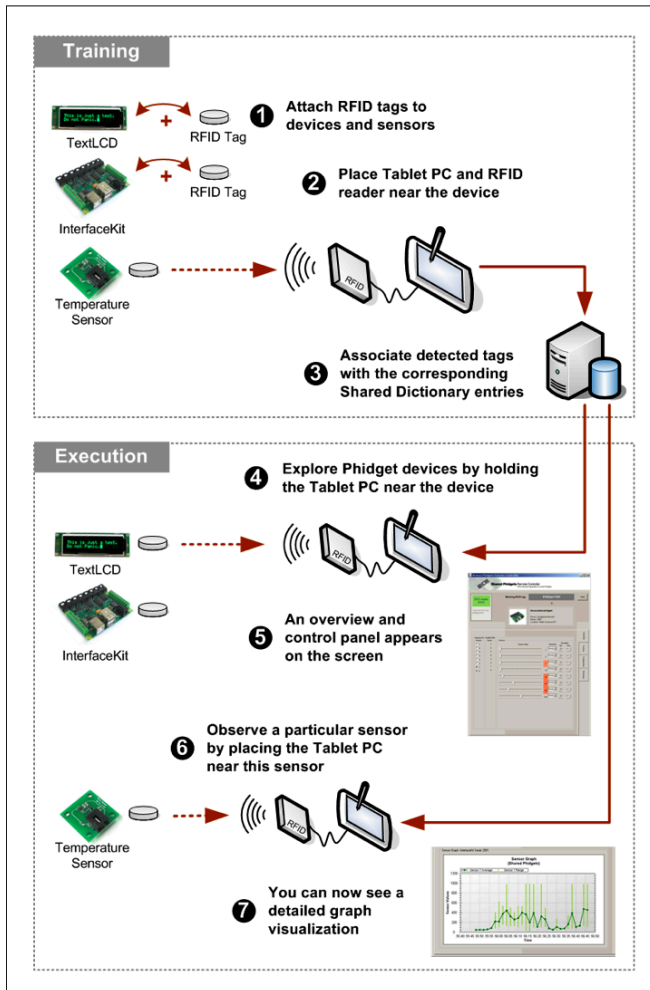
```

01. SharedDictionary sharedDictionary
02. public Form1 () {
03.     InitializeComponent();
04.     this.timer.Tick += new System.EventHandler(this.timer_Tick);
05.     ConnectionManager connectionManager new ConnectionManager();
06.     connectionManagerSharedDictionaryURL= "tcp://136.159.xx.xx:sp";
07.     this.sharedDictionary= connectionManagerGetSharedDictionary();
08. }
09. private void timer_Tick(object sender, System.EventArgs e) {
10.     double averageTemperature= 0.0;
11.     double counter= 0.0;
12.     foreach(SharedDictionaryEntry i in
13.         (this.sharedDictionary"/sharedphidget#phidgetinterfaceki/*sensor/3"] as IEnumerable) {
14.         counter +=1;
15.         averageTemperature+= ((int)i.Value - 200.0) / 4.0;
16.     }
17.     this.textBox.Text = "Average Temperature " + (averageTemperature/ counter) + " °C"; }
    
```

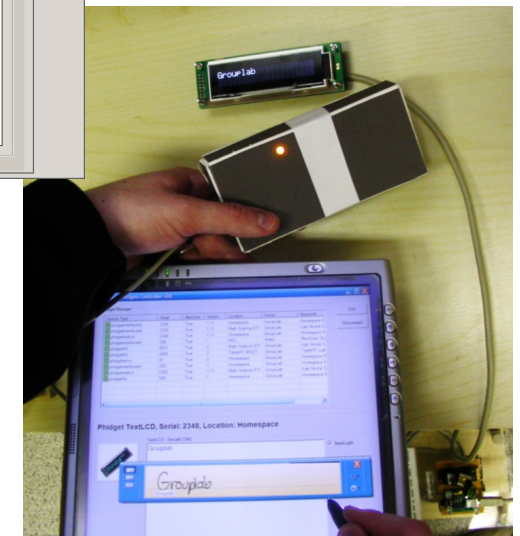
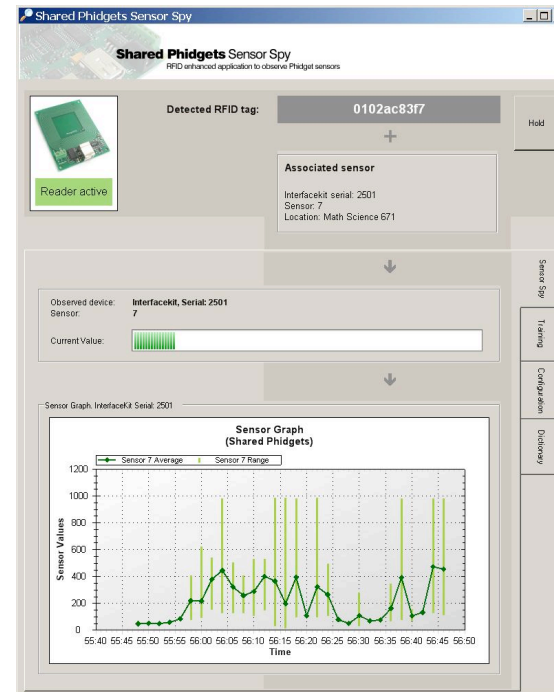
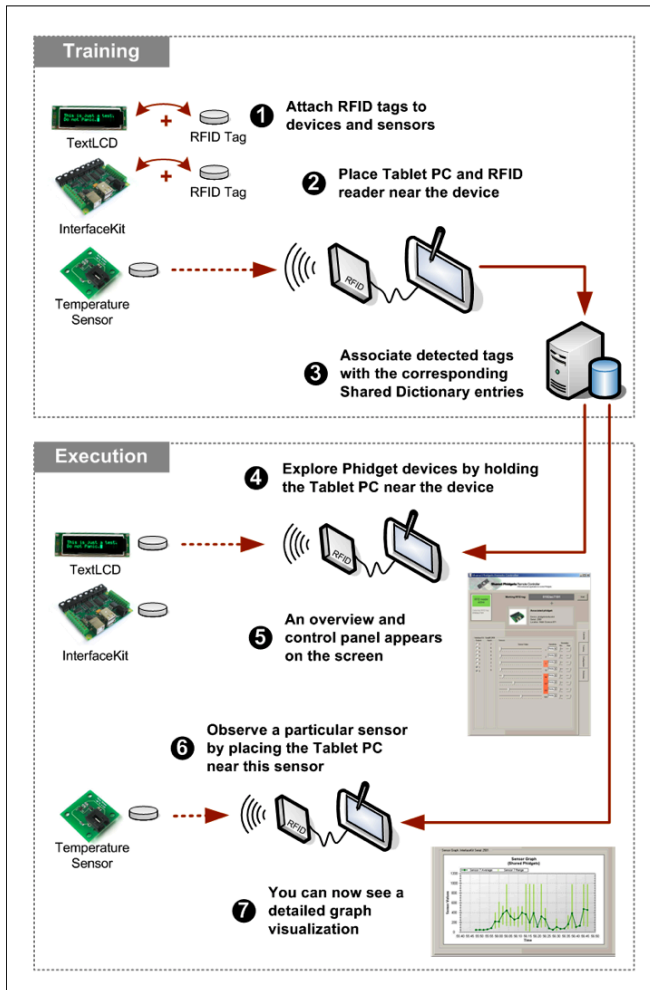
The Temperature Display



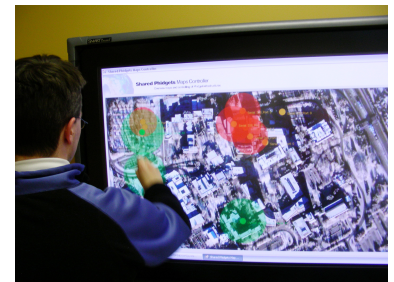
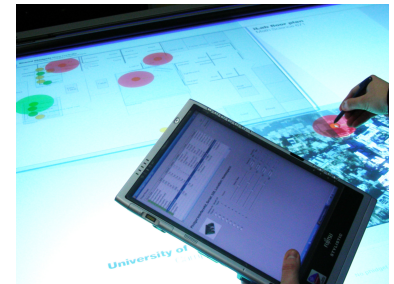
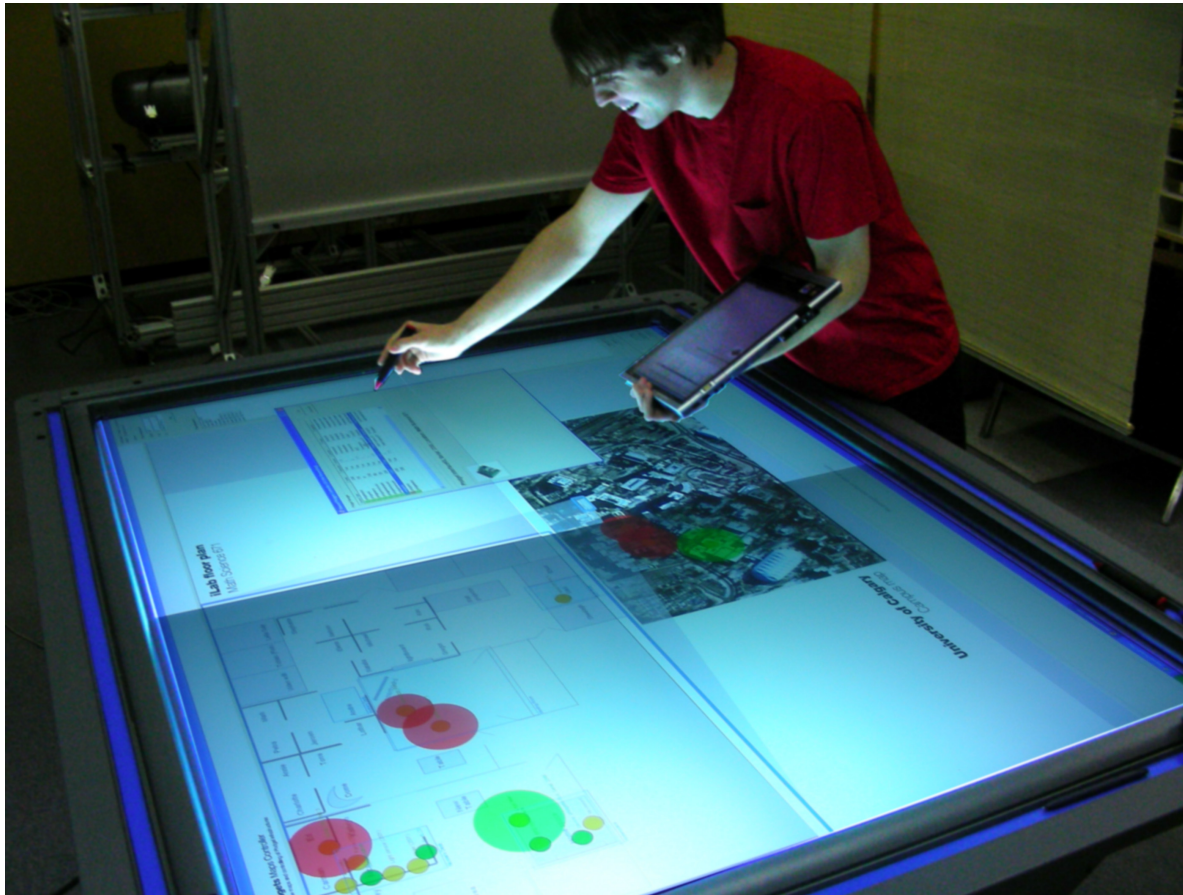
Applications and Tools: Tablet Explorer



Applications and Tools: Tablet Explorer



Using the Shared Phidgets Maps



Getting Started

The iLab Cookbook: Download, Tutorials, Examples

<http://grouplab.cpsc.ucalgary.ca/cookbook/>

Marquardt, N. and Greenberg, S. (2006)

Shared Phidgets: A Toolkit for Rapidly Prototyping Distributed Physical User Interfaces. Report 2006-829-22, Department of Computer Science, University of Calgary, Calgary, Alberta, Canada, T2N 1N4. April.

The screenshot shows the Shared Phidgets website homepage. At the top, there is a navigation bar with 'New', 'Edit', 'History', and 'Print' buttons. Below this is the 'Shared Phidgets' title and a brief description: 'With the Shared Phidgets Toolkit developers can easily create new applications based on distributed physical user interface elements. These Phidget devices use USB components, e.g. sensors, sliders, motion sensors, temperature sensors, buttons, LED, RFID reader and Text LC displays.' There are several sections: 'Contents' with links to 'Download and Installation', 'Recipes, How-To's', 'Tutorials and Examples', and 'Links'; 'Download and Installation' with a link to the 'Shared Phidgets toolkit download page' and a description of the setup; 'Recipes and How-To's' with a list of links for various tasks like 'How to use the Connection Manager' and 'How to get information from a Shared Phidgets Dictionary path'; 'Tutorials' with links to 'Setup a new SharedPhidgets sensor' and 'Using the Shared Phidgets Connector'; and 'Examples Step-by-step' with links to 'Simple Example: Controlling a servo' and 'Simple Example: Using the RFID reader'. A search bar is located at the bottom left of the page.

This screenshot shows a tutorial page titled 'Example Using A Slider To Control A Servo'. It includes a 'What you will learn in this tutorial:' section with bullet points: 'how to create a SharedPhidgets servo object', 'how to create a SharedPhidgets potentiometer object', 'how to assign a specific sensor number to these components and', and 'how to let a slider sensor to control the servo.' Below this is a 'Download source: SharedPhidgetsExample_SliderServo.zip!' link. The 'Overview' section lists steps: 1. Attach the device, 2. Create a new Windows C# application in VisualStudio.NET, 3. Use the ConnectionManager to connecting to the sensor, 4. Create a servo object, 5. Create a potentiometer object, 6. Assigning sensor number to control the servo, and 7. Finished! Compile the application! The 'Step-by-step in detail' section provides instructions for attaching the device and opening VisualStudio.NET. A screenshot of the VisualStudio.NET interface is shown at the bottom, with a red box highlighting the 'Add New Project' button.

This screenshot shows a tutorial page titled 'How To Get Information From A Shared Phidgets Dictionary Path'. It includes a 'What you will learn in this tutorial:' section with bullet points: 'how to use the SharedPhidgets Dictionary Path to get information from a shared dictionary', 'how to use the SharedPhidgets Dictionary Path to get information from a shared dictionary', and 'how to use the SharedPhidgets Dictionary Path to get information from a shared dictionary'. Below this is a 'Download source: SharedPhidgetsExample_DictionaryPath.zip!' link. The 'Overview' section lists steps: 1. Attach the device, 2. Create a new Windows C# application in VisualStudio.NET, 3. Use the ConnectionManager to connecting to the sensor, 4. Create a servo object, 5. Create a potentiometer object, 6. Assigning sensor number to control the servo, and 7. Finished! Compile the application! The 'Step-by-step in detail' section provides instructions for attaching the device and opening VisualStudio.NET. A screenshot of the VisualStudio.NET interface is shown at the bottom, with a red box highlighting the 'Add New Project' button.

This screenshot shows a tutorial page titled 'Moving existing Phidgets .NET Applications To Shared Phidgets'. It includes a 'What you will learn in this tutorial:' section with bullet points: 'how to move existing Phidgets .NET applications to Shared Phidgets', 'how to move existing Phidgets .NET applications to Shared Phidgets', and 'how to move existing Phidgets .NET applications to Shared Phidgets'. Below this is a 'Download source: SharedPhidgetsExample_MovingExistingPhidgets.zip!' link. The 'Overview' section lists steps: 1. Attach the device, 2. Create a new Windows C# application in VisualStudio.NET, 3. Use the ConnectionManager to connecting to the sensor, 4. Create a servo object, 5. Create a potentiometer object, 6. Assigning sensor number to control the servo, and 7. Finished! Compile the application! The 'Step-by-step in detail' section provides instructions for attaching the device and opening VisualStudio.NET. A screenshot of the VisualStudio.NET interface is shown at the bottom, with a red box highlighting the 'Add New Project' button.

... and ...

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