Multimodal Human Robot Interaction

Mark Swaine
Project Goals

• To develop different methods of interaction between humans and robots
• To develop a system that manages inputs from different interfaces
• To ascertain which interface is best suited to effective human-robot interaction
System Architecture
The Server

- Manages the data being sent from the different modalities
- Handles the communication between the Lego NXT Robot and the computer
- Communicating with the Lego NXT robot is done using a channel created between the computer and the robot by means of a Bluetooth COM port.
The Server

- Developed in C# using Microsoft Visual Studio 2008 and the .NET Framework 3.5
- Use of NKH.Mindsqualls library – API to communicate with the Lego NXT robot
The Server

• Listens for incoming connections on port 3000
• Multithreaded
The Server

• Server protocol:
  – <modality>;<power>;<turnRatio>
  – Eg: xbox360;60;7
**Nintendo Wiimote**

- Connects to computer over Bluetooth
- Picks up changes in motion, thereby possibly being an effective gestural interface
- Tilting motions used to control speed and direction
Nintendo Wiimote

- Developed in C# using Microsoft Visual Studio 2008 and the .NET Framework 3.5
- WiimoteLib library as an API to communicate with the Wiimote
Nintendo Wiimote

- The accelerometer is extremely sensitive, so adjustments had to be made to desensitize the returned values
Microsoft Xbox 360 Controller

• is a suitable tangible user interface for controlling robot movement
• connects to a computer using a Microsoft wireless receiver
Microsoft Xbox 360 Controller

- Forward-Backward
- Left-Right
Microsoft Xbox 360 Controller

- Developed in C# using Microsoft Visual Studio 2008, the .NET Framework 3.5 and the Microsoft XNA Framework
- Microsoft XNA Framework is aimed at game development for the Windows and Xbox 360 platforms – simplifies integration of game controllers
Web

• Web 2.0 revolutionises methods of interaction, styles of development and content
• The idea of Web 2.0 is to let users run applications entirely through a browser without any local machine installation
• Achieved with AJAX (Asynchronous JavaScript And XML)
Web

- Developed in Java using the Eclipse IDE and the Google Web Toolkit (GWT)
- GWT enables rapid development of AJAX applications through asynchronous remote procedure calls
- GWT cross-compiles from Java to JavaScript
Web

• Use arrow keys to navigate the Robot

• Java applet displays webcam
Mobile

• Allows for remote mobile robot interaction
• Makes use of a Mobile Information Device Profile (MIDP)-enabled mobile phone
Mobile

- Developed in Java using the Eclipse IDE and the Java 2 Micro Edition framework
- Use arrow keys or numeric keypad to navigate the robot
Results

• Currently in the process of obtaining results.
• Test involves navigating the robot around obstacles using each of the modalities and determining which method of interaction is the most effective.
Demo
Questions...