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ADVANCED PERVASIVE COMPUTING

Lecture 3: Intelligent Environments and UbiComp User Interfaces

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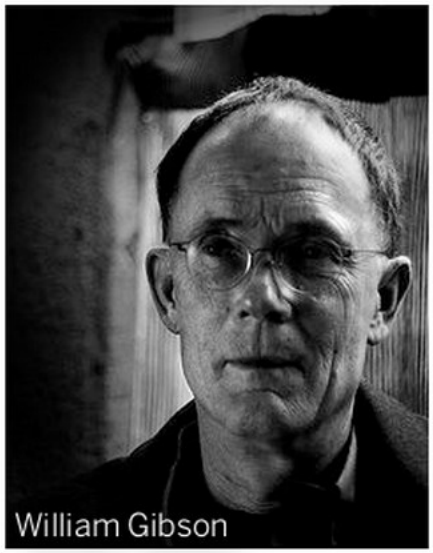
AGENDA

- Intelligent Environments
- Smart Cities
- Smart Homes
- Smart Spaces
- User interfaces
- AAL Smart Homes
- ADL
- IE Challenges
- Focus for Exam



"The future is already here, it's just not evenly distributed."

INTELLIGENT ENVIRONMENTS

Intelligent environments are spaces in which computation is seamlessly used to enhance ordinary activity (Steventon &Wright 2006)

One of the driving forces behind the emerging interest in highly interactive environments is to make computers not only genuine user-friendly but also essentially invisible to the user (Steventon &Wright 2006)

SHAPES AND SIZES …

- Smart Cities
- Smart Homes
- Smart Spaces
  - Factories
  - Pig pens
  - Offices
  - Desks
  - White boards
  - Patient beds
  - Healthcare measurement stations

- Ubicomp User Interfaces (UUI)
  - Supplement or replace existing interaction device types?

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SMART SPACES

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SMART SPACES

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ENABLING TECHNOLOGIES

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Activity tracking

UBICOMP USER INTERFACES

- Present day user interfaces inadequate
- - fixed computers with keyboards and mouse
- - smart phones and tablets also have their limitations

- Do you always carry your phone or tablet?
- - in the shower? … or to the toilet?
- - in the kitchen while cooking? To the pig pen?
- - while driving, eating, training, sleeping, relaxing?

- New class of alternative UI devices needed
- - smart watches, voice recognition, intelligent surfaces (walls, doors, tables)
- - face/eye tracking, hand gestures
- - implicit interaction (getting up from the couch or the bed will turn on the light), intelligent floor, PIR

- Challenges with new UI devices
- - neither developers nor users have experience, states multiplied by several magnitudes as compared to traditional computing
- - more field studies needed to understand the setting / device context over time and space
- - frequent, rapid, and longitudinal prototyping is needed to test the effects in changing situations
- - consider the need for multi modal interaction (allowing for several UI)

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NOVEL CLASSES OF UUI'S

- Tangible User Interfaces (TUI)
- Interact with physical objects, input and output
-
- Surface User Interface (SUI)
- Utilizes a surface to act as a display and/or input,
- Is either a screen or a projected image

- Ambient User Interfaces (AUI)
- Ambient technologies are ignorable or glanceable, speech, lights
- They are in the periphery of our attention (peripheral vision)

- Context-aware User Interfaces (CUI)
- Interfaces that reacts on context but are otherwise invisible
- Implicit interaction, medication cabinet opens when relevant

- Artificial Reality Interfaces (ARI)
- Produces an overlay of information on real objects
- Google glasses, projected image on milk with expiry date

EXERCISE 3A

› Create a Ubicomp User Interface

- › Must support Context Sensitive Reminder Dialogs – e.g. Medication Reminders
- › User arrives in the bathroom, remind user to take medication, if not taken within 2 minutes
- › Consider skipping the medication detection part for first prototype

› Use Context sensors to react to user presence

- › We shall use Phidget sensors to detect user presence and medication moved
- › Download drivers and source code from http://phidgets.com

› Use Artificial Speech Technology to interact with the user

- › We shall use System.Speech to interact with the user

› Time

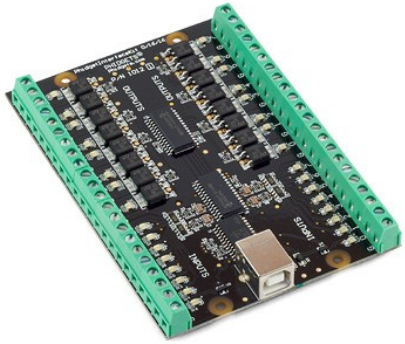
- › 1 hour (including break)

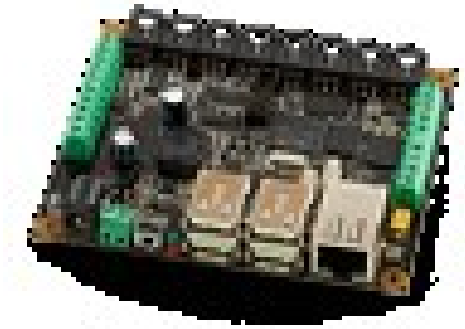
SYSTEM.SPEECH

```
using System;
using System.Speech.Synthesis;

namespace SampleSynthesis
{
  class Program
  {
    static void Main(string[] args)
    {

      // Initialize a new instance of the SpeechSynthesizer.
      using (SpeechSynthesizer synth = new SpeechSynthesizer())
      {

        // Configure the audio output.
        synth.SetOutputToDefaultAudioDevice();

        // Speak a string synchronously.
        synth.Speak(“Good morning. Please remember to take your medication. Thank you!");
      }

      Console.WriteLine();
      Console.WriteLine("Press any key to exit...");
      Console.ReadKey();
    }
  }
}
```

PHIDGETS

- Connects easily to PC using USB
- Basic Analog & Digital I/O
- I/O with USB Hub
- Advanced Single Board Computer
  - Running Linux
  - C++ / Java on-board
  - USB / LAN / Wifi Connection





SENSOR TYPES

- Distance
- Sonar
- Inductive proximity
- Pressure
- Light
- Humidity
- Magnetic
- Temperature
- Accellerometer
- Current/Voltage

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HOOK IT UP – AND YOU ARE READY!

```
//Declare an InterfaceKit object
static InterfaceKit ifKit;

static void Main(string[] args)
{
    try
    {
        //Initialize the InterfaceKit object
        ifKit = new InterfaceKit();

        //Hook the basica event handlers
        ifKit.Attach += new AttachEventHandler(ifKit_Attach);
        ifKit.Detach += new DetachEventHandler(ifKit_Detach);
        ifKit.Error += new ErrorEventHandler(ifKit_Error);

        //Hook the phidget spcific event handlers
        ifKit.InputChange += new InputChangeEventHandler(ifKit_InputChange);
        ifKit.OutputChange += new OutputChangeEventHandler(ifKit_OutputChange);
        ifKit.SensorChange += new SensorChangeEventHandler(ifKit_SensorChange);

        //Open the object for device connections
        ifKit.open();

        //Wait for an InterfaceKit phidget to be attached
        Console.WriteLine("Waiting for InterfaceKit to be attached...");
        ifKit.waitForAttachment();

        //Wait for user input so that we can wait and watch for some event data
        //from the phidget
        Console.WriteLine("Press any key to end...");
        Console.Read();

        //User input was rad so we'll terminate the program, so close the object
        ifKit.close();

        //set the object to null to get it out of memory
        ifKit = null;

        //If no expcetions where thrown at this point it is safe to terminate
        //the program
        Console.WriteLine("ok");
    }
```