mbed
Research Projects

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Summary

- USB capabilities
  - Mouse
  - Keyboard
  - Audio
- Closed loop control
- DSP and audio processing
- Arts and culture based research projects
  - Technology for music therapy
  - Sonic art
- The Internet of Things and Websockets
- From mbed to manufacture

USB capabilities

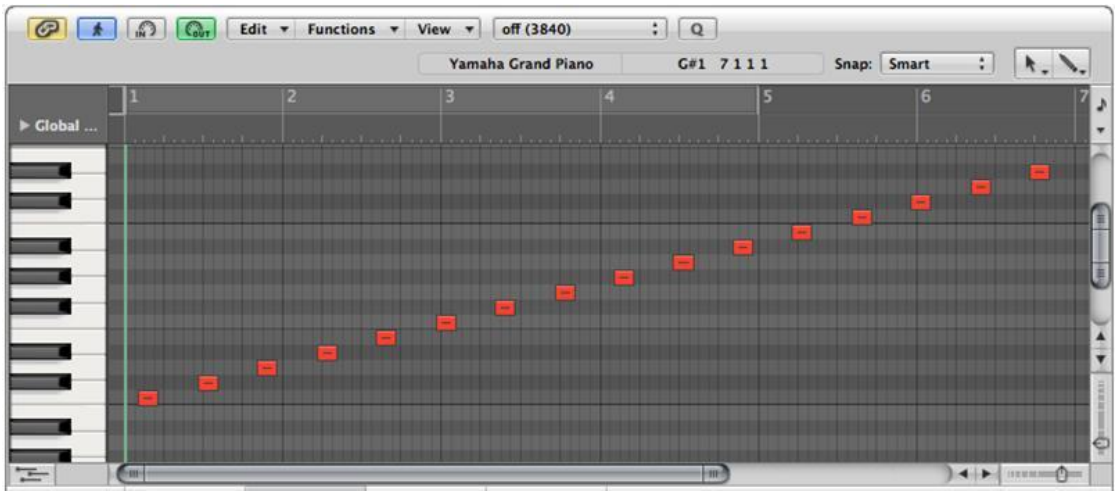
Using the mbed to emulate a USB mouse

```
/* Program Example: Emulating a USB mouse
                                                                */

#include "mbed.h"                       // include mbed library
#include "USBMouse.h"                   // include USB Mouse library
USBMouse mouse;                         // define USBMouse interface

int dx[]={40,0,-40,0};                  // relative x position co-ordinates
int dy[]={0,40,0,-40};                  // relative y position co-ordinates

int main() {
  while (1) {
    for (int i=0; i<4; i++) {           // scroll through position co-ordinates
      mouse.move(dx[i],dy[i]);          // move mouse to co-ordinate
      wait(0.2);
    }
  }
}
```

USB capabilities

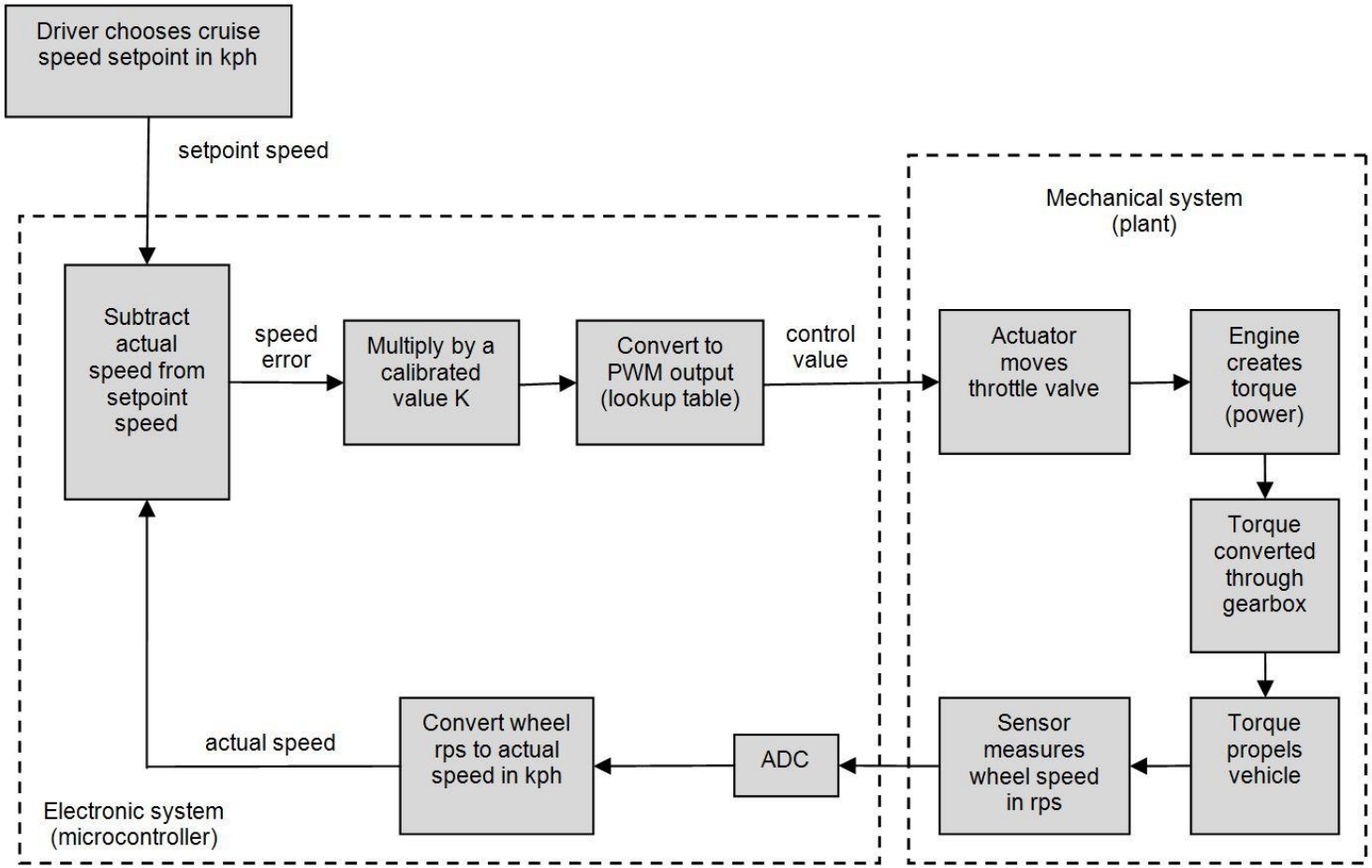
```
/* Program Example: MIDI messaging with variable scroll speed
                                                                */
#include "mbed.h"
#include "USBMIDI.h"
USBMIDI midi;                          // initialise MIDI interface
AnalogIn Ain(p19);                     // create analog input (potentiometer)

int main() {
    while (1) {
        for(int i=48; i<72; i++) {                  // step through notes
            midi.write(MIDIMessage::NoteOn(i));     // note on
            wait(Ain);                              // pause
            midi.write(MIDIMessage::NoteOff(i));    // note off
            wait(2*Ain);                            // pause
        }
    }
}
```

The output of the program example is shown here in the MIDI control window of Apple Logic software.



Closed loop control

Closed loop cruise control example – proportional control



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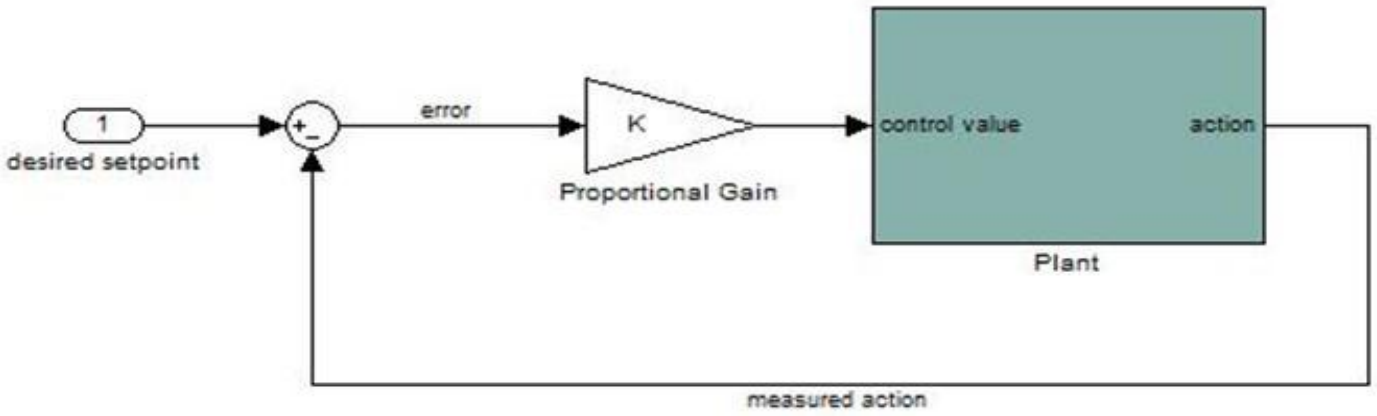
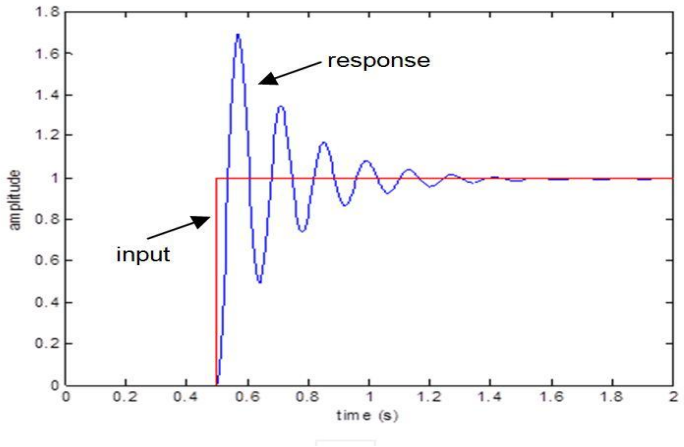
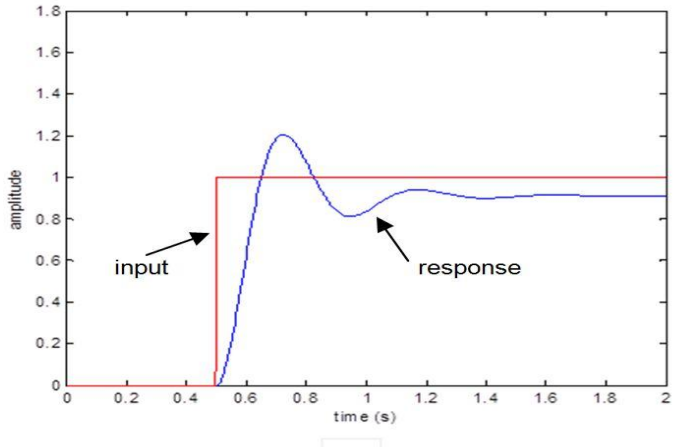
Closed loop cruise control example – proportional control



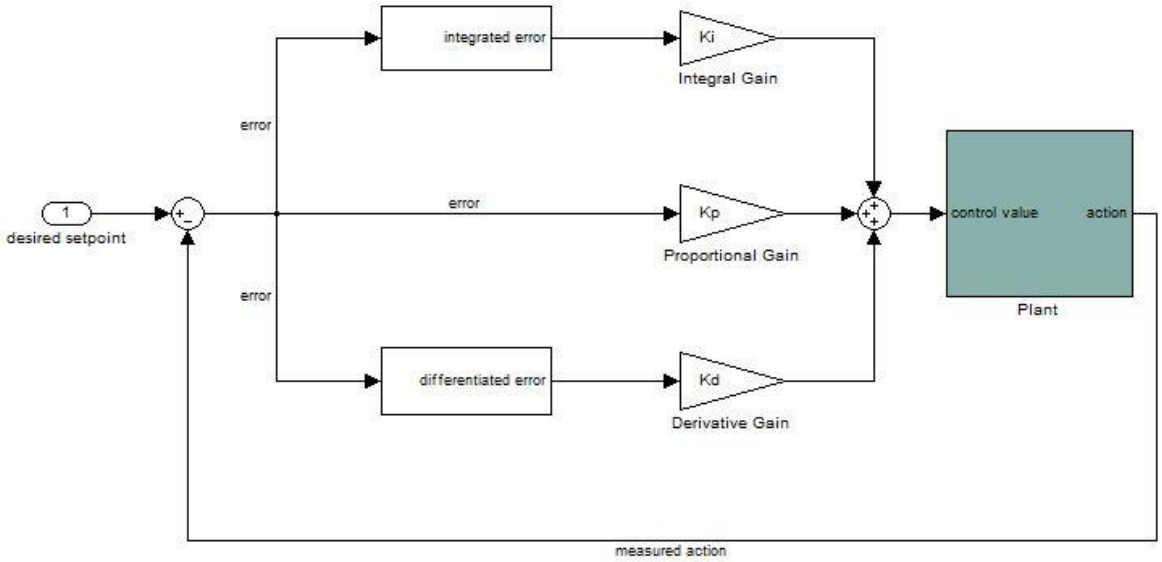


A – high gain

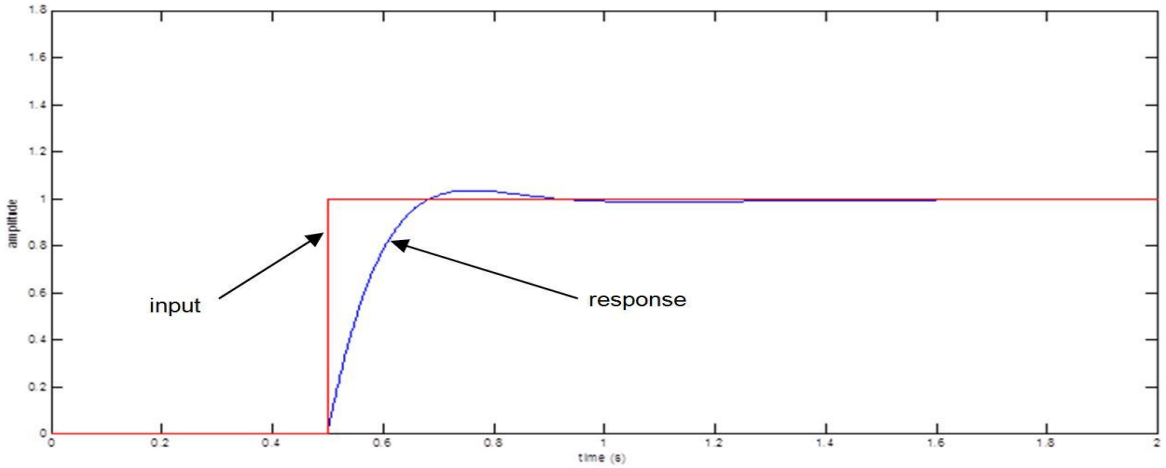


B – low gain

Closed loop control

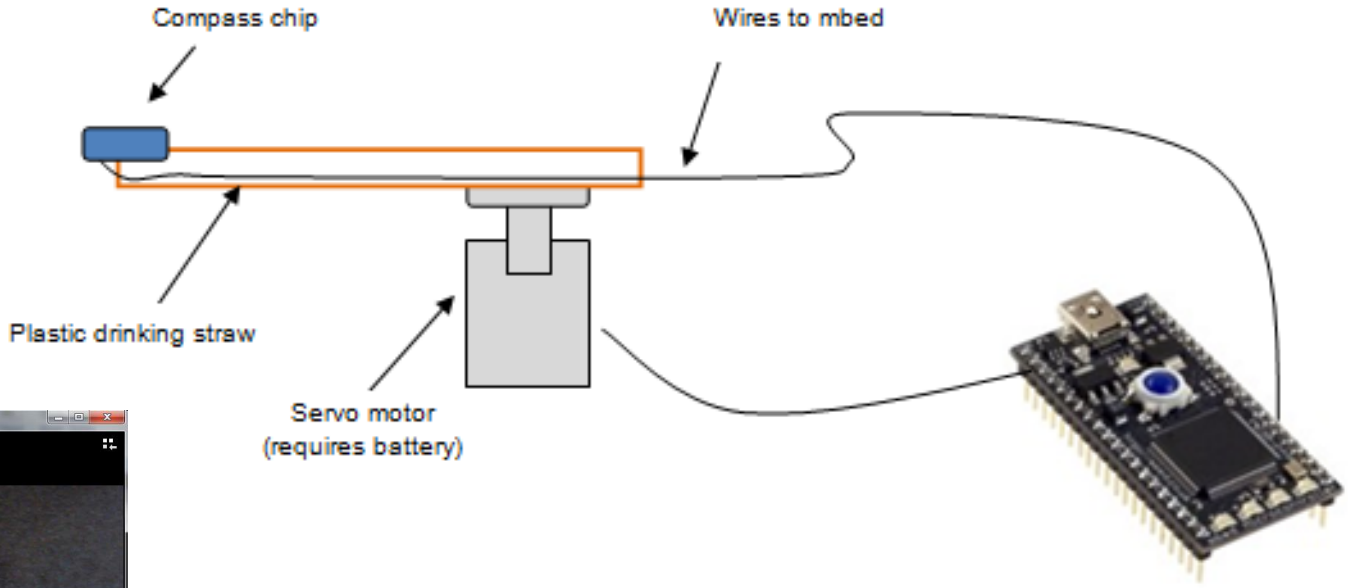


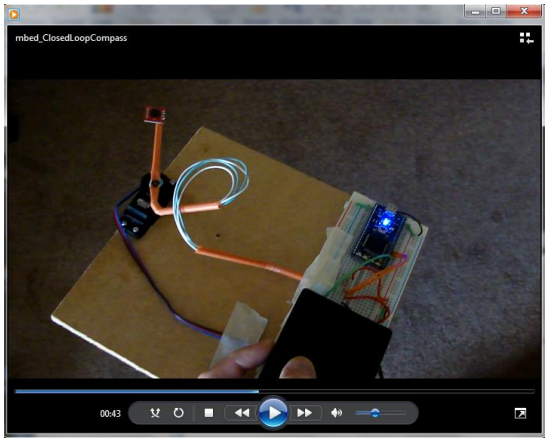
PID control



Closed loop control

Closed loop compass example

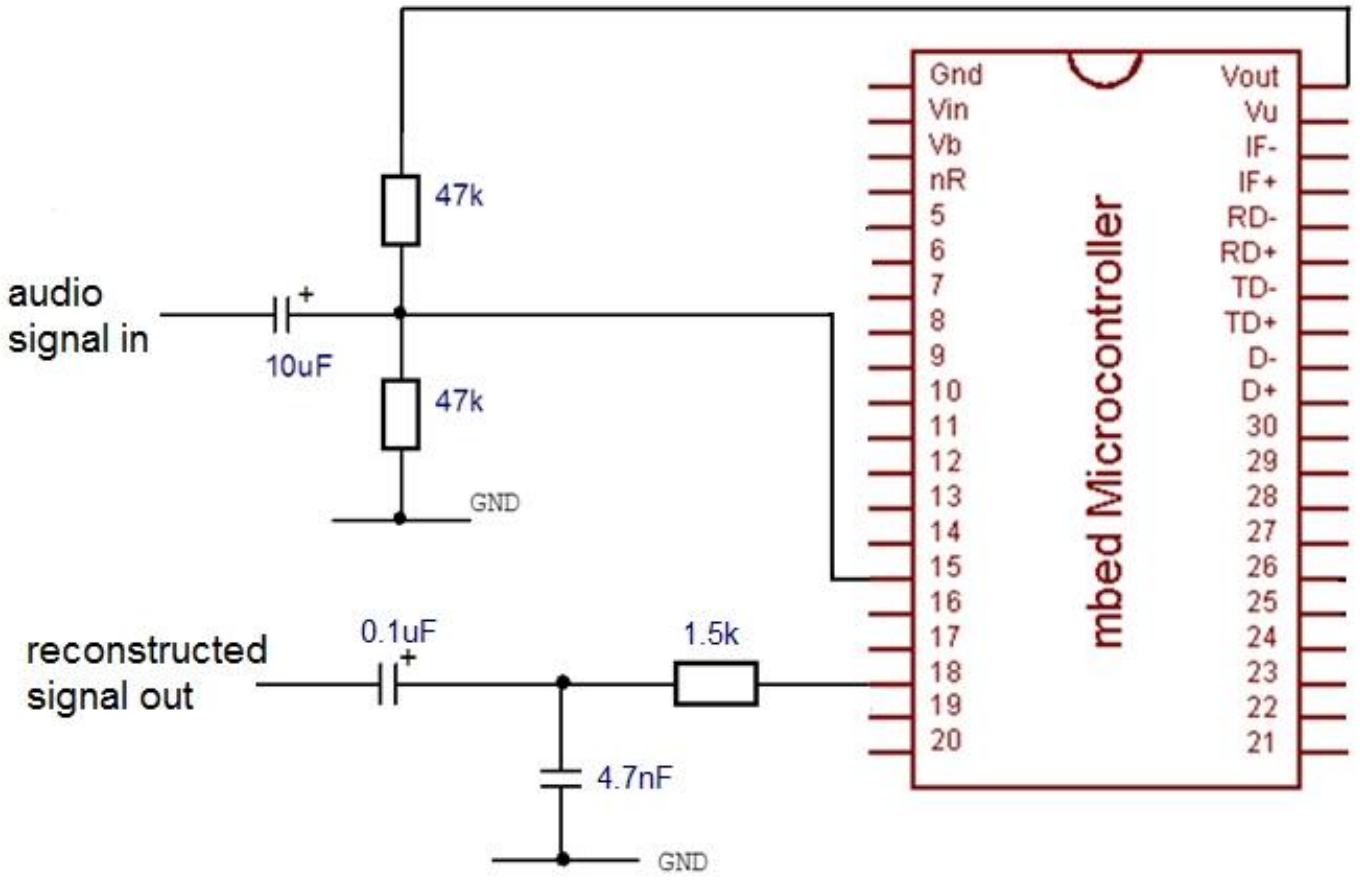




www.youtube.com/watch?v=ybz-6vZYxyc

DSP and audio processing

Digital delay guitar effect



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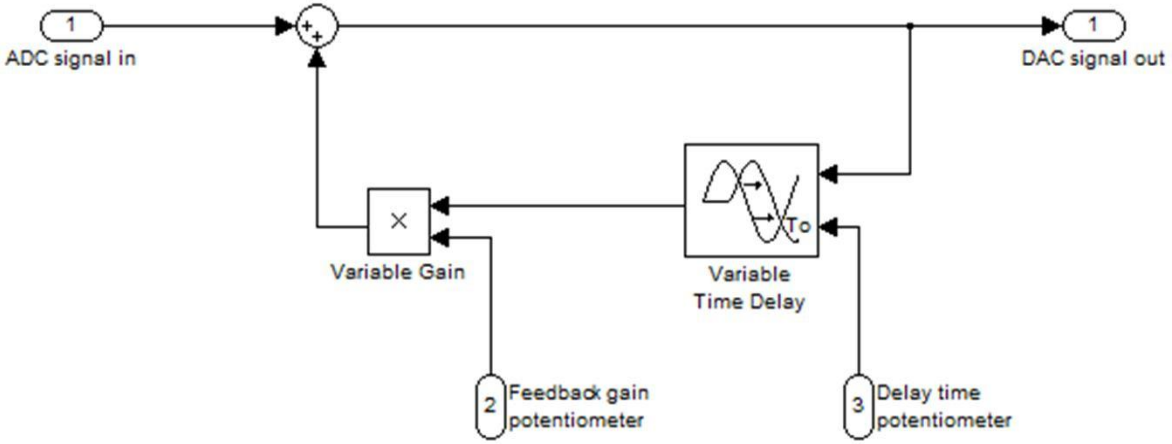
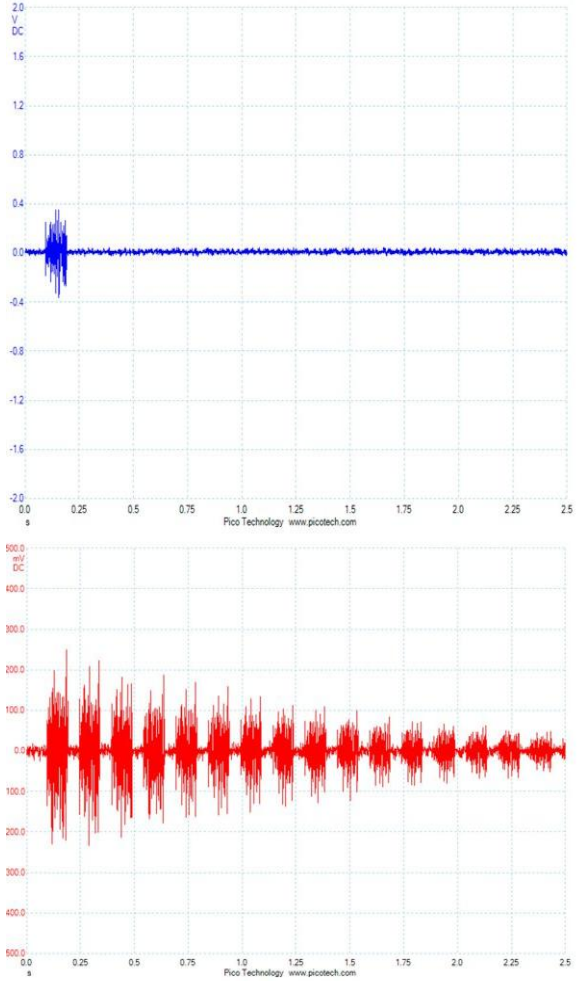
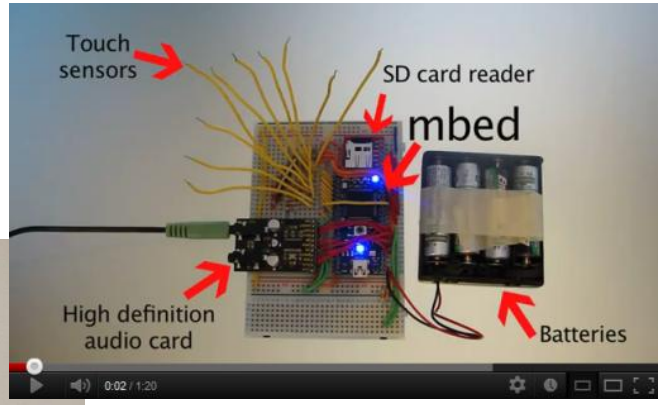




The Lagoglyph Sound System

By artist Eduardo Kac

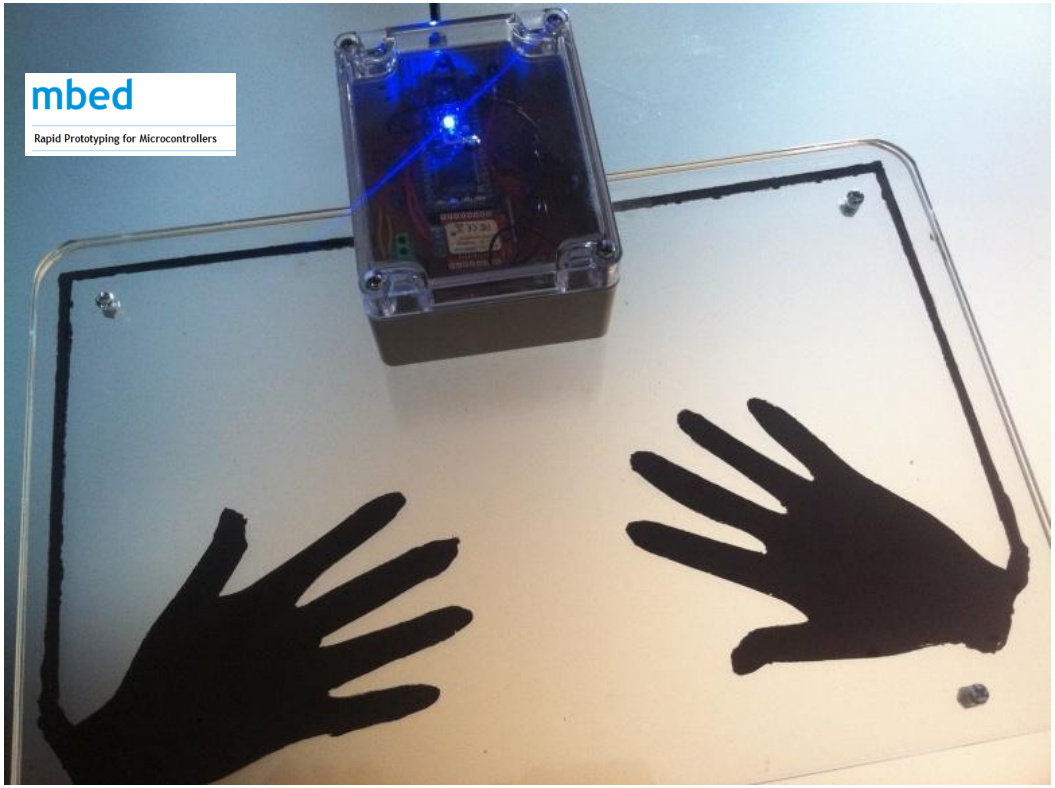
http://www.youtube.com/watch?v=cCYn7oQlLiA

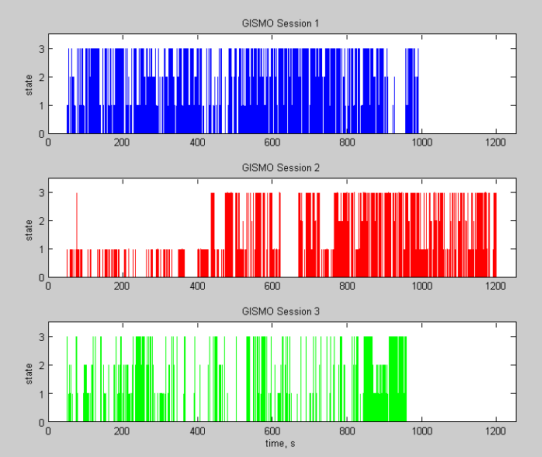


Technology for music therapy

Opportunities:

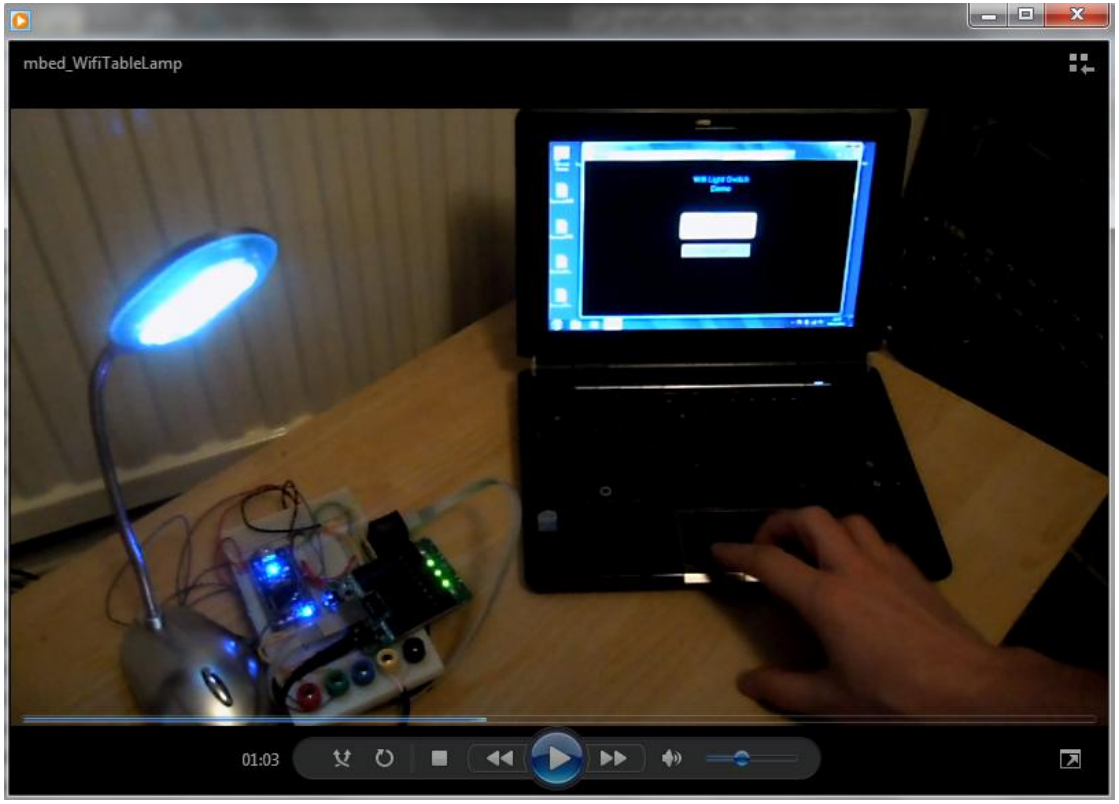
- A new musical instrument
- Greater participation
- Analysis and evaluation
- Remote therapy
- Invisible vs visible technology

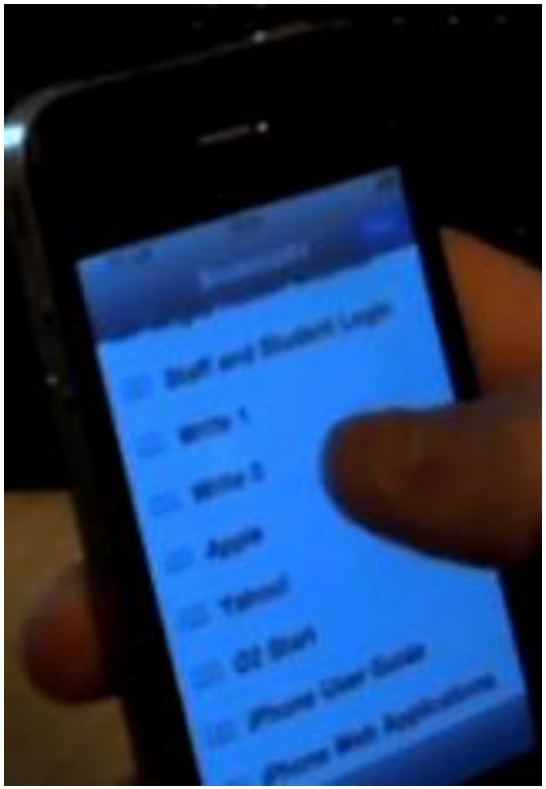




The Internet of Things

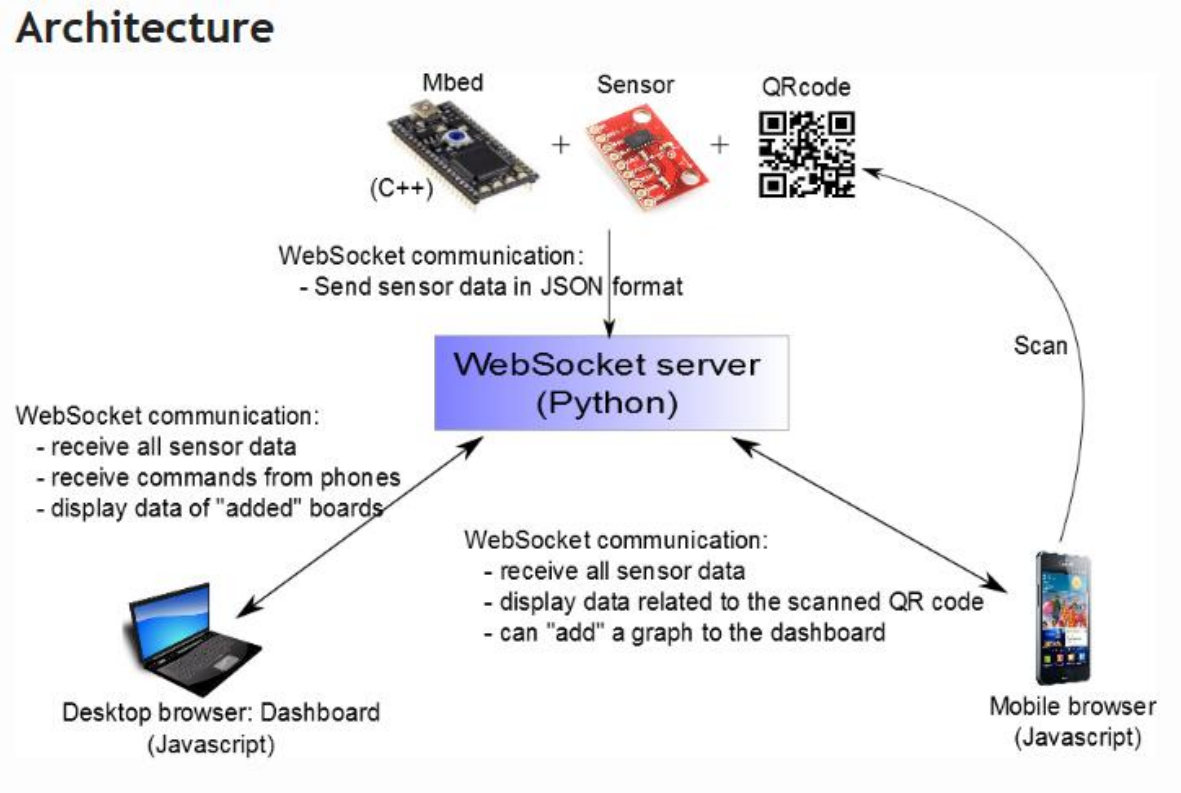
Wi-fi networked table lamp





http://www.youtube.com/watch?v=Lsg2T5xX5a8

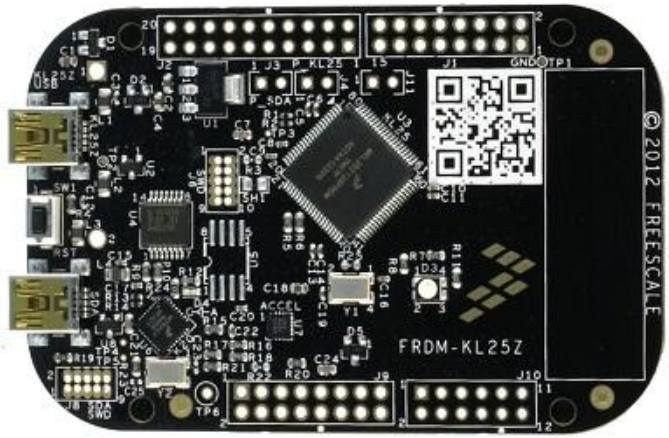
The Internet of Things: Websockets



From mbed to manufacture

Bespoke PCB based on the mbed, showing the LPC1768 in place

Freescale freedom development platform for mbed design for medium scale production



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Q&A

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