[ Rhythm Reloaded ]
Team 6 Final Presentation
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Mechanical Stethoscopes

- Chestpiece: metal casing with diaphragm
- Earpiece: hollow tubing with spring
Electrical Stethoscopes

- Preserve look
- Bulky and Heavy
- Limited recording
- Slow data transfer
An electronic stethoscope that will:
- Aid in auscultation
- Perform frequency filtering
- Record digital audio data from the patient
- Store the audio files on the device
- Transfer the audio files to a computer via USB
- Contain these features in a convenient media-player like form-factor
- Provide a wireless chestpiece
Design Decision - Microprocessor

• Main Criteria:
  • USB Device functionality
  • DSP Functionality (Hardware Multiply)
  • Power consumption
  • Clock Speed
  • RoHS compliance

• Minor Considerations
  • Available memory, removable media interface, GPIO, ADC, price, dev kit

• Choice: Freescale MCF5275
## Design Decision – Operating System

<table>
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<th>Weight</th>
<th><strong>uCLinux</strong></th>
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<th>FreeRTOS</th>
<th>eCos</th>
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<th>Nucleus RTOS</th>
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Welcome to uClinux

For further information check: http://www.uclinux.org/

Execution Finished, Exiting

Sash command shell (version 1.1.1)
/> helloWorld
Hello World!

Welcome to Rhythm Reloaded's M5275EVB!
Design Decision - Wireless

• Considerations
  • Range & Reliability
  • Power Consumption & Bandwidth
  • Development Time

• Choice: F2M03MLA:
  • Benefits:
    • Made for Streaming 16bit Audio
    • Small Efficient Package
    • Full FCC Qualification
    • Built in Firmware
  • Deterrents:
    • Cost
Design Decision – Chestpiece Power Supply

• Choices:
  • Battery – Li-ion
    • Greater energy density
    • More common
  • Supercapacitor
    • Higher risk - unique
    • Quicker charge time

• Choice:
  • Two 10F 2.7 Volt supercapacitors in series
    • Estimated Typical Runtime = 13 minutes at 22mA (observed current)
    • Estimated Minimum Runtime = 4 minutes at 75mA (datasheet max.)
Progress – Chestpiece Design

[Diagram of a circuit board with labels and components]

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Alternative Solution

Conclusion
Progress

- Firmware in flash
- Bootloader is complete
- Breadboard prototyping
  - LCD functional
  - CODEC control functional
  - Bluetooth control functional
  - Audio streaming non-functional
- Filter algorithms complete
- WAV encoding/decoding software complete
- Chestpiece prototype in testing
- I2C, SPI, UART, EPMOD drivers (mostly) complete

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- During debug, microprocessor board shorted out
- Board no longer boots
- Replacement board not available until May 15

Dramatization
The Alternative Solution

• Embedded platform emulated on PC running Ubuntu Linux and Qt graphics
• Beltpack is replaced by computer, chestpiece design unchanged
The Alternative Solution - Progress

- Wireless audio streaming functional
- Digital filtering, recording, and playback complete
- Qt GUI design complete
- Analog electronics complete
- Noise issues remain
The Alternative Solution - Progress

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The Alternative Solution - Progress

```c
uint16_t *decodedData;

sampleCount = 0;
int decodedSampleCount = 0;

// Create the recording stream */
if (!((r = pa_simple_new(NULL, "audioLoop", PA_STREAM_RECORD, NULL, "record", &ss, NULL, NULL, &error)))) {
    fprintf(stderr, __FILE__": pa_simple_new() failed: %s\n", pa_strerror(error));
    return NULL;
}

// Create the playback stream
if (!((p = pa_simple_new(NULL, "audioLoop", PA_STREAM_PLAYBACK, NULL, "playback", &ss, NULL, NULL, &error)))) {
    fprintf(stderr, __FILE__": pa_simple_new() failed: %s\n", pa_strerror(error));
    return NULL;
}

// this is essentially a state machine, but progression from one state to another is instigated by a change in
// the global state variables which are set by the GUI thread
while (!powerDown) {
    switch (myState) {
    case listenState:
    case deleteState:
        if (streamAudio(r, p, buf, sizeof(buf), NULL) != 0) {
            fprintf(stderr, __FILE__": streamAudio failed with PA error code: %s\n", pa_strerror(error));
        }
        break;
    case recordState:
        switch (myRecorderState) {
    case Record_PreRecordState:
    case Record_FileEnterState:
        // stream like normal until user chooses a filename
        if (streamAudio(r, p, buf, sizeof(buf), NULL) != 0) {
            fprintf(stderr, __FILE__": streamAudio failed with PA error code: %s\n", pa_strerror(error));
        }
        break;
    case Record_RecordingState:

```
• What we have learned
  • Burritos are the 7\textsuperscript{th} food group
  • Misleading marketing and poor product support are big problems
  • Device interfaces are very important
  • Open-source software is not always functional

• What we would do differently
  • Microprocessor selection
  • Add 5\textsuperscript{th} team member – mechanical
  • Wireless design
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- Prof. Steven VanderLeest
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- Zach Luchies
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Questions?

Rhythm Reloaded supports GNU/Linux