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Expertise

- Dana Berke – Processor/Software
- Stephanie Hellner – Power/Software
- Ben Hildebrand – Mechanics/Motors
- Justin Kane – Board Layout/Software

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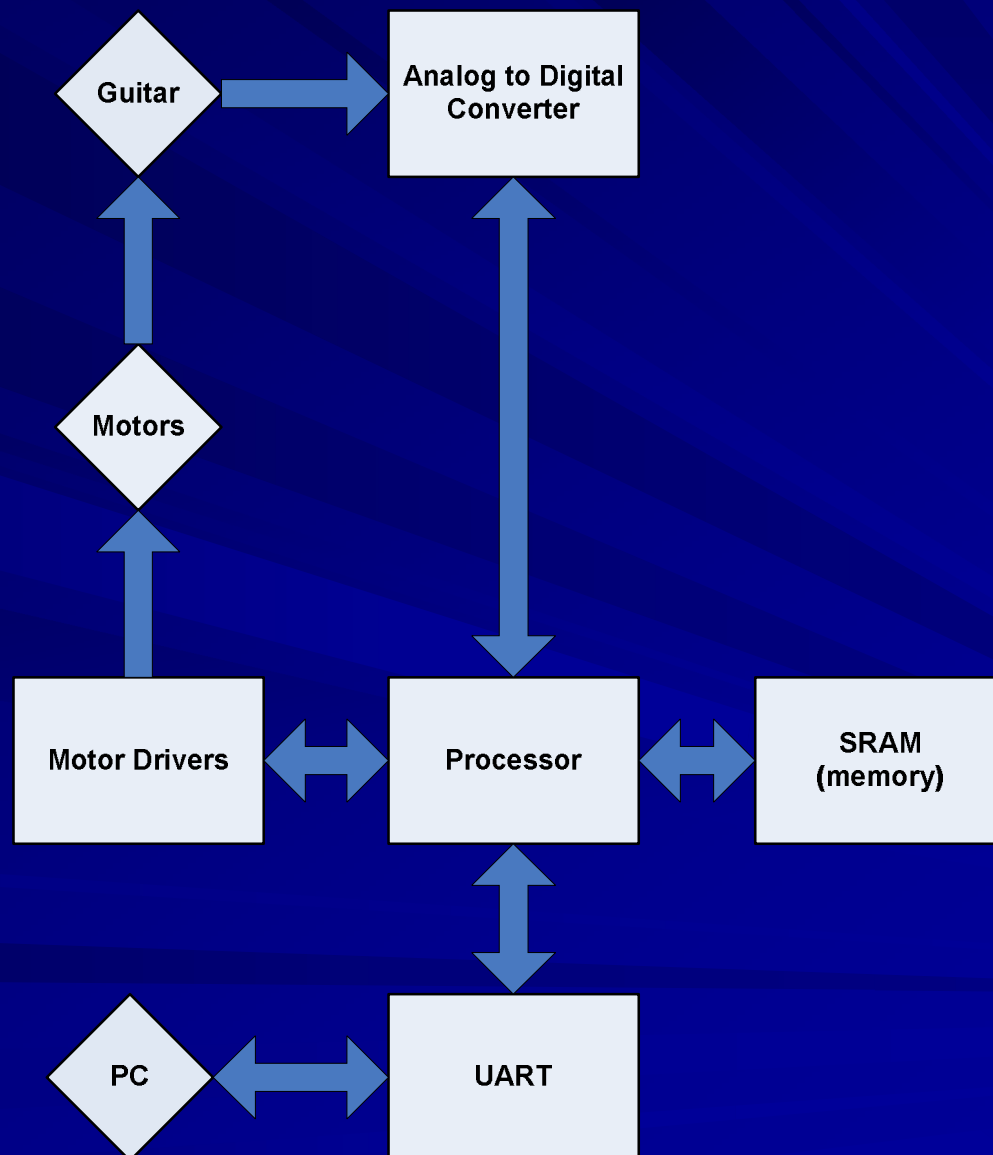
Product Description

- Automatic guitar tuner
- OneStrum™ adaptive tuning technology
- Fully user configurable
- Automatic peg-turning system
- Simple, intuitive user interface



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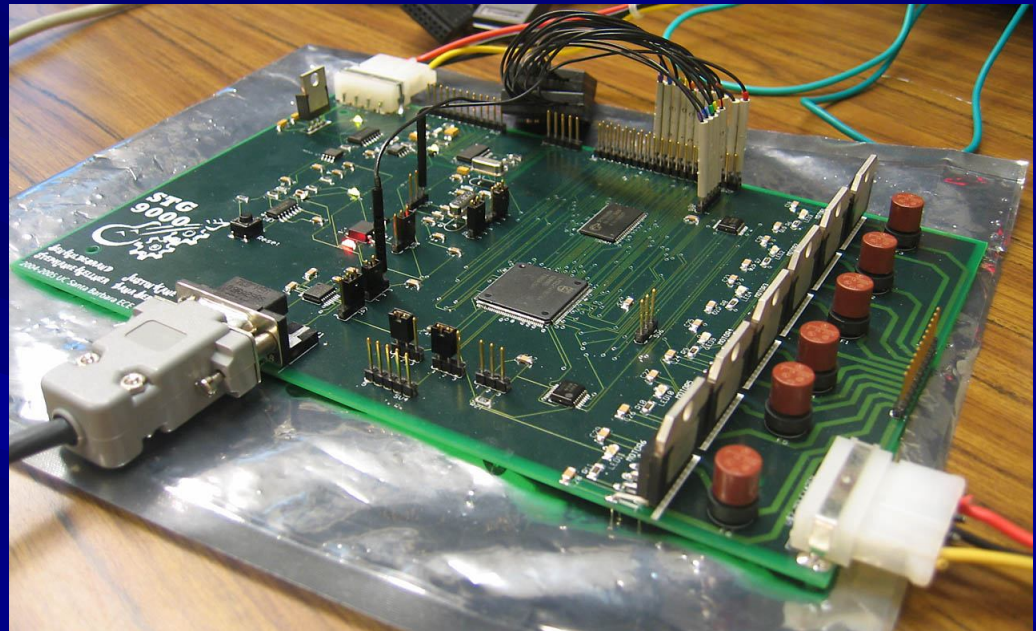
Block Diagram



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Product Specifications

- Six input channels
- 24-bit sampling
- Calculates pitch with 99.7% accuracy
- Graphical User Interface via PC
- Removable motor mount

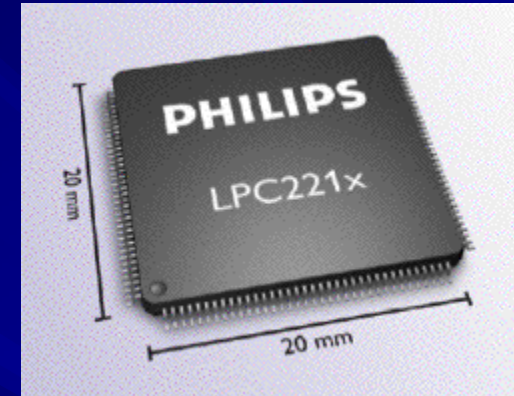


System Specifications

- Two external power supplies: +-6V, +20V
- All digital voltages regulated to proper level from +6V input voltage
- Power Supply Requirements
 - +6V for Roland guitar pickup
 - 20V for Motors
 - 3.3V for Processor, SRAM, ADC, other chips
 - 1.8V for Processor core
 - 5V for miscellaneous chips
- Clock Domains: 15.00 MHz crystal for processor, 7.68 MHz crystal for ADC

Processor Definition

- Philips LPC2214
- ARM7 Core
- 60 MHz maximum operating frequency
- 15.00 MHz External Crystal
- Keil Development Software



Processor Continued

- Serial Bus (RS-232), SPI Bus
- PWM - Pulse With Modulation, motor control
- On chip 16KB SRAM and 256KB FLASH Memory
- 16-bit External memory interface (18-bit Addressing)

J External Memory Interface

- Cypress CY7C1041CV33-15ZC SRAM
- 3.3V Power Supply
- 16-bit Data (D[15:0]), 18-bit Addressing (A[17:0])
- Memory Mapped Addresses from
0x8000 0000 – 8003 FFFF
- 10ns access time

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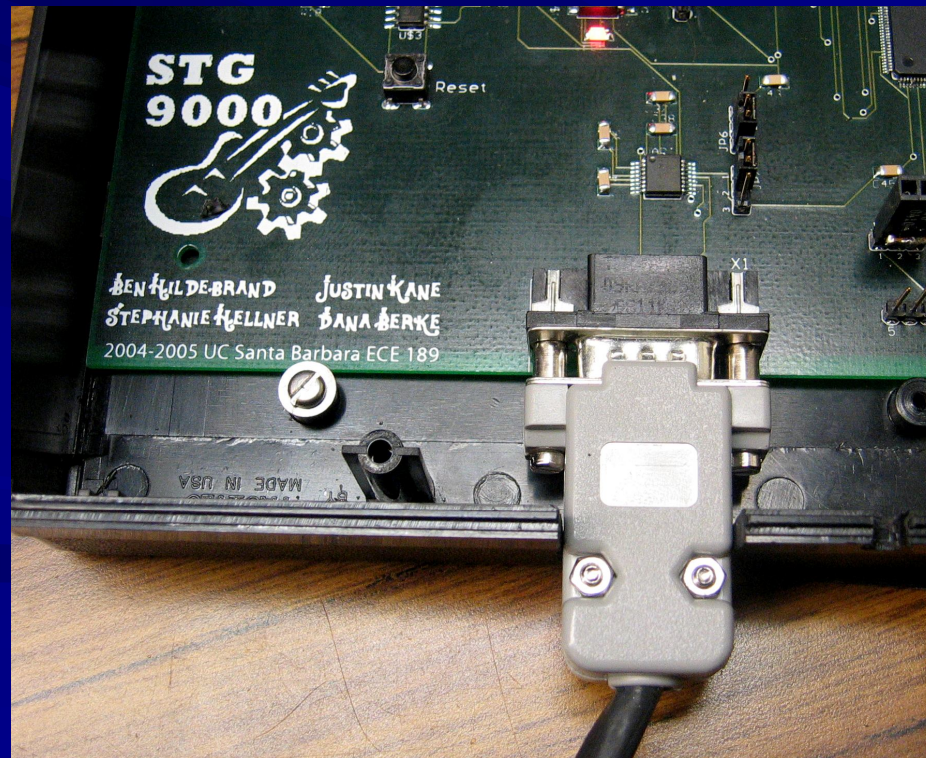
ADC Interface

- Communicates with CPU over SPI Bus
 - 1.875MHz SPI clock
 - Configures ADC, issues read commands, receives audio data
- Custom driver for ADC communication
 - Uses interrupts for fast response time
 - 5% CPU usage for 2KHz sampling

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PC Interface

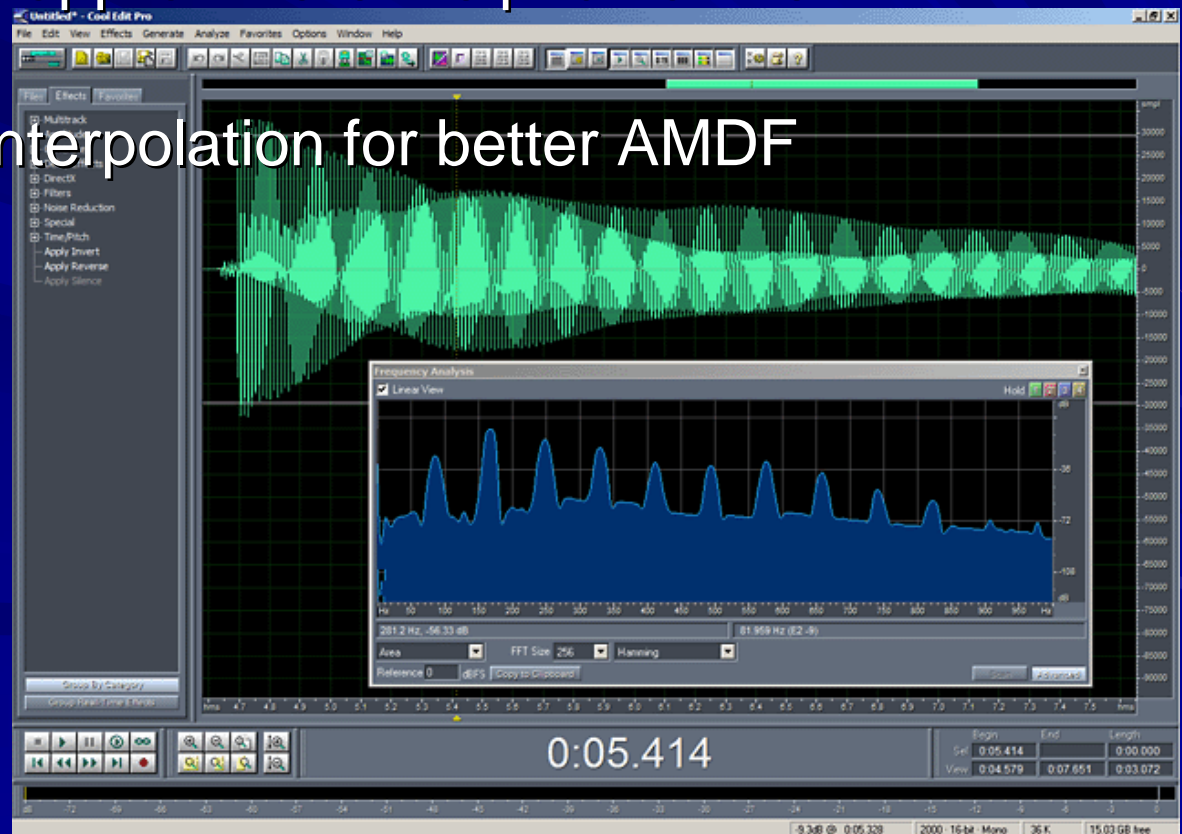
- UART – RS-232 Serial Interface
- Used to load programs into Flash Memory
- Communicates with PC GUI



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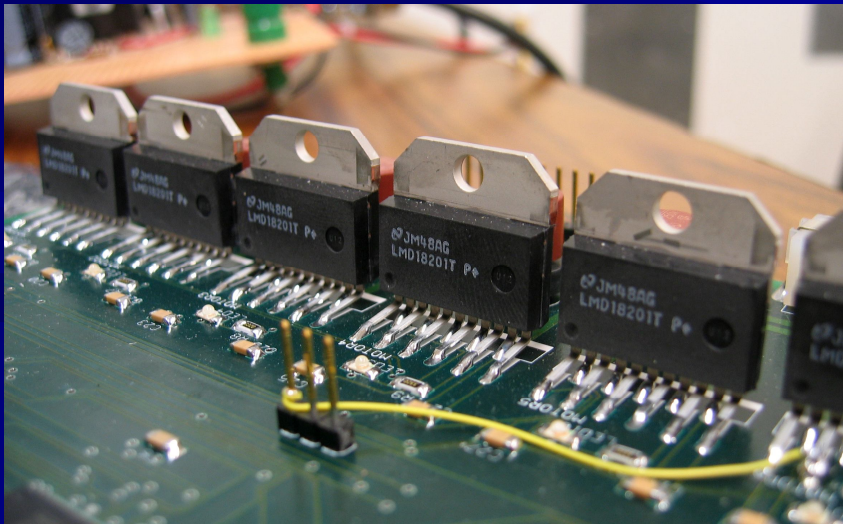
Pitch Detection Algorithm

- Average Magnitude Difference Function (AMDF)
 - AMDF finds the approximate the pitch of the string
 - Use quadratic interpolation for better AMDF accuracy



Motor Interface

- National Semiconductor LMD18201 Motor Driver
- 6 Single edged PWM signals and 6 GPIO direction pins for all drivers
- Max 400mA per motor



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Mechanics

- Antweight robot gearmotors
 - 247 oz-in stall torque at 12V
 - 104:1 gearing
- Motor mounts attach motors to tuning pegs via Spin Doctors™



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Guitar Interface

- 6 Analog Signals (output from each string)
- +/- 6 volt power supply
- 13-pin connector to guitar

