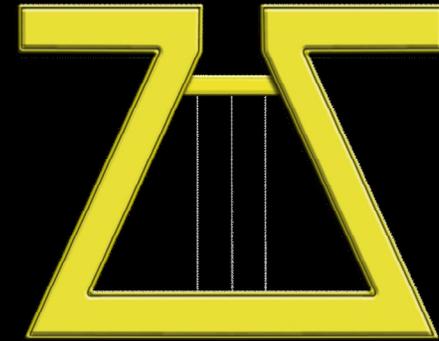
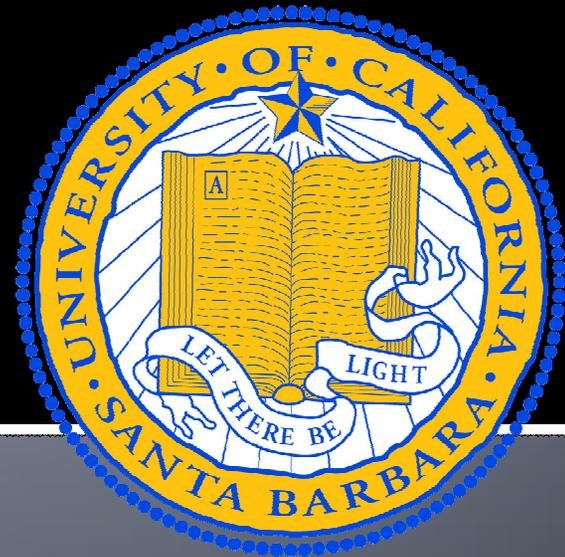


MU.S.E.



Musically Stimulated Environment

UCSB ECE 189 A/B Senior Capstone 2013



Group Members: Tim Chin, Omar Gonzalez, Ward Huang

What is Mu.S.E.?

- Mu.S.E. is your musical companion for the modern era.
- An embedded light sensor reads in ambient light levels
- Combining this with an internal time clock, Mu.S.E. is able to automatically select the perfect playlist to stimulate your environment.
- By simply swiping your hand in front of the device, Mu.S.E. automatically begins playing
- Mu.S.E. sets the tone for any occasion

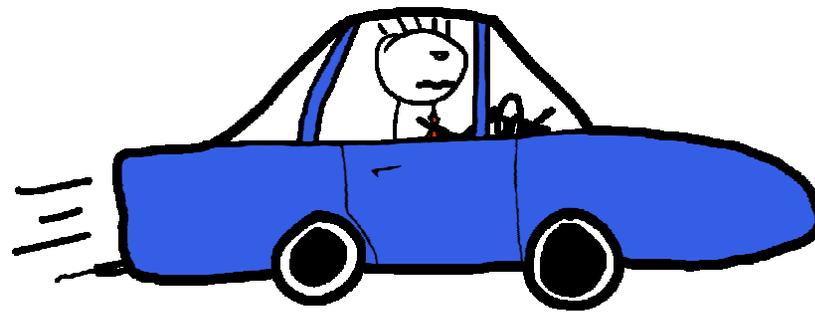
Picture this...



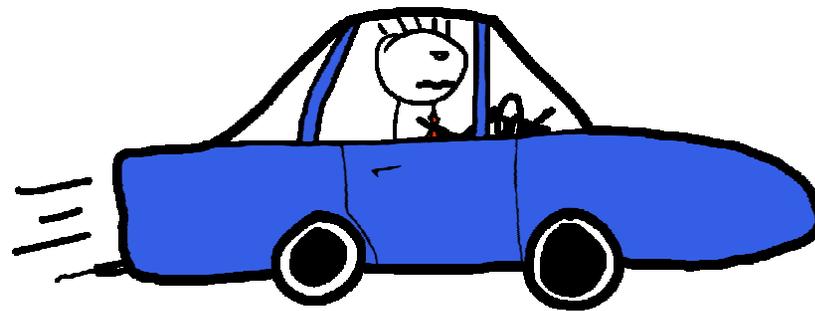
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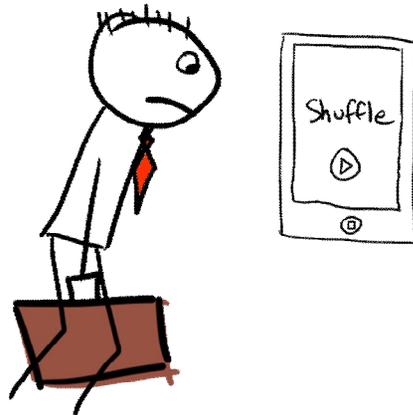
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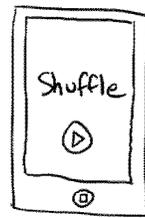
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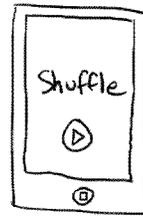
Picture this...



Picture this...



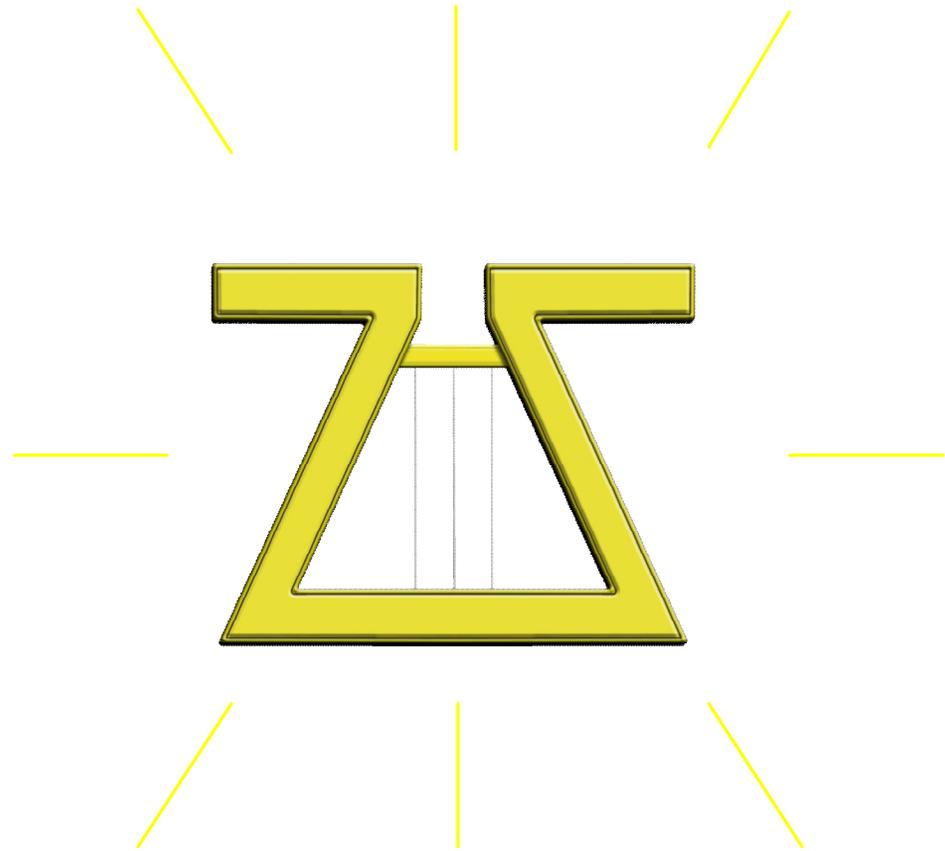
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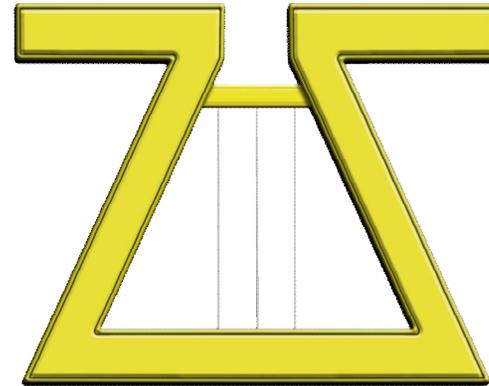
Picture this...



Picture this...

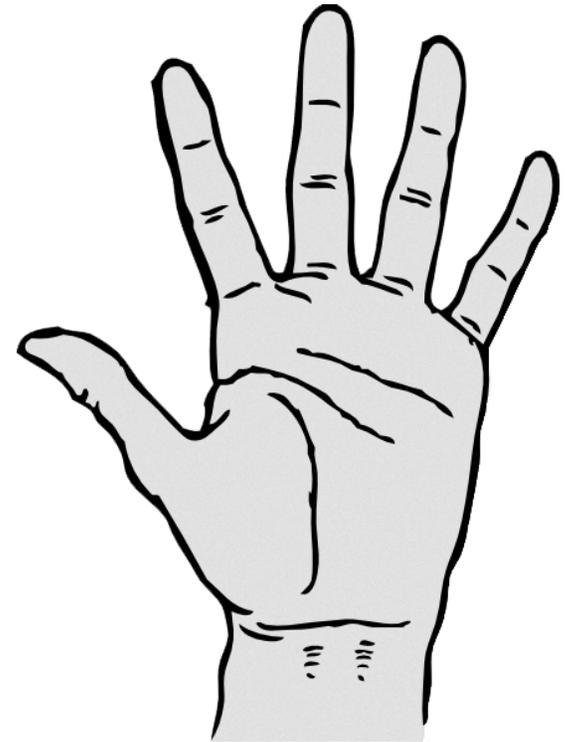
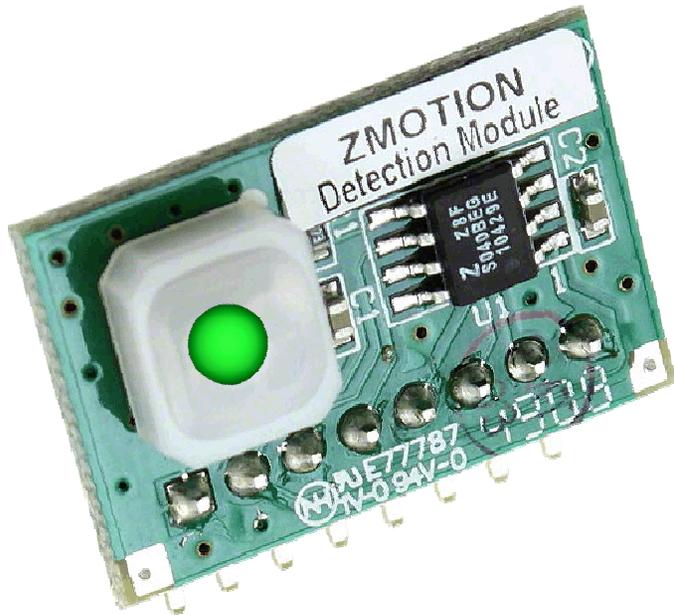


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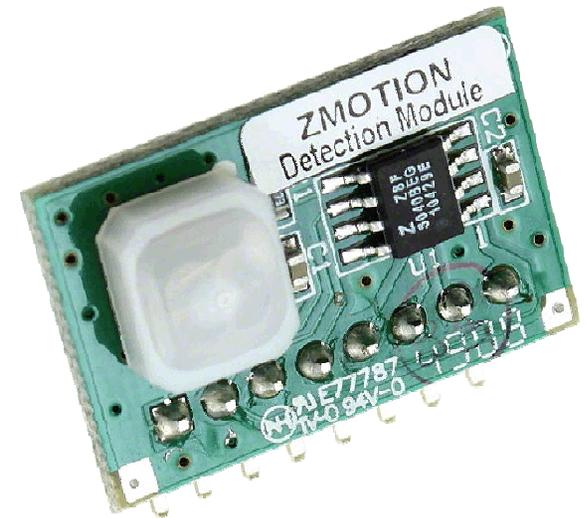
But how does it work?

How Does Motion Detection Work?



PIR: ZMotion Module Z8FS040

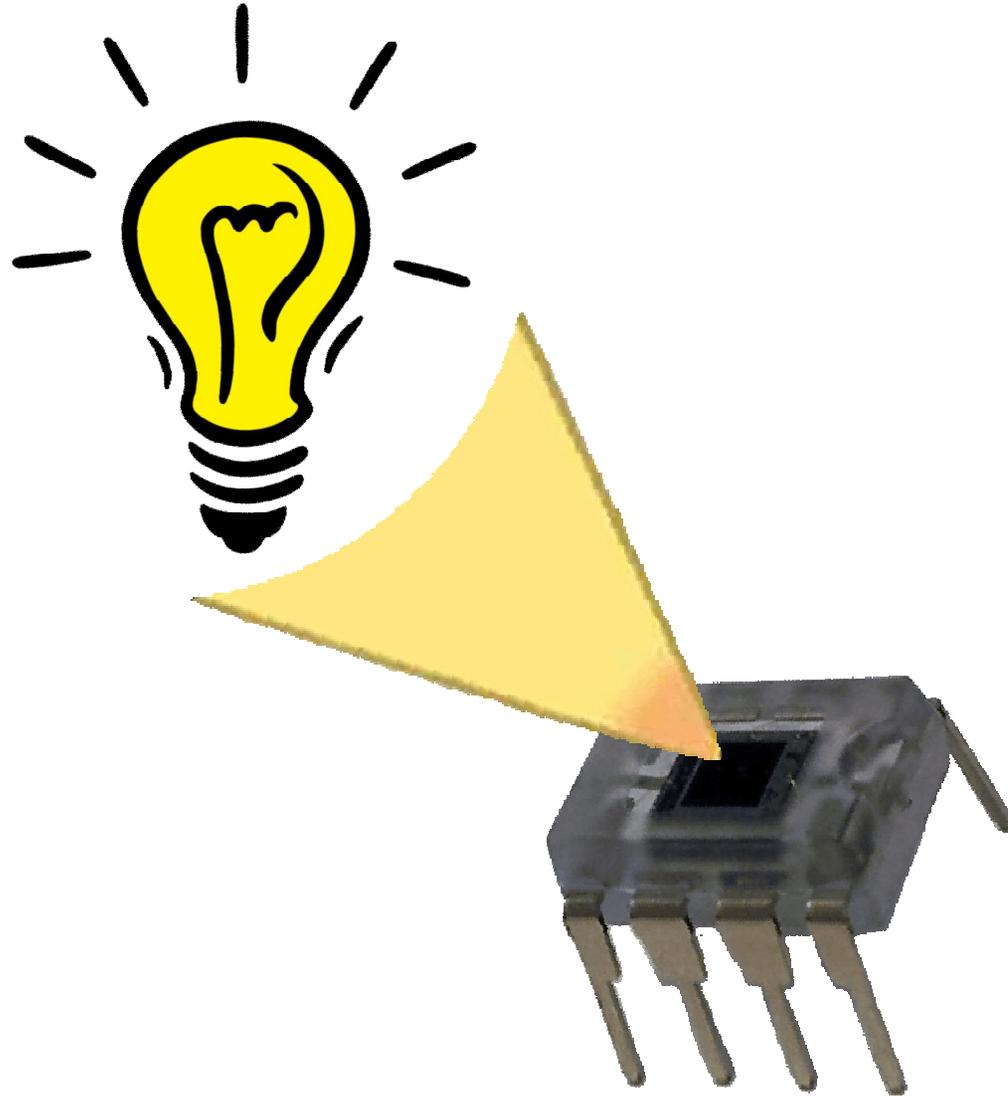
- Complete motion detection solution
- Surface-mount pyroelectric sensor and low-profile lens
- Wide 5m x 6m, 60-degree detection pattern
- Two different configurations:
 - Hardware – Direct output
 - Advanced Serial UART – “Talk” to CPU



CPU Communication

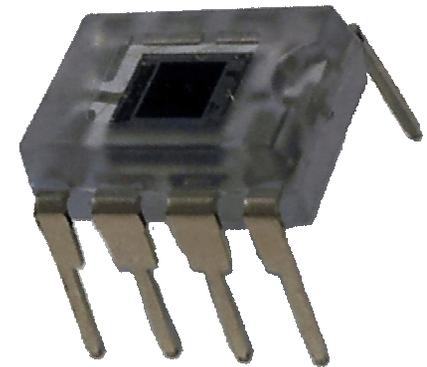


How Does Light Sensing Work?

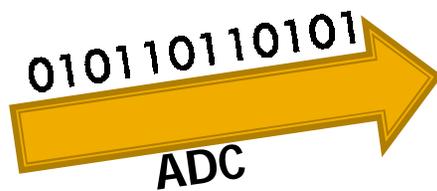
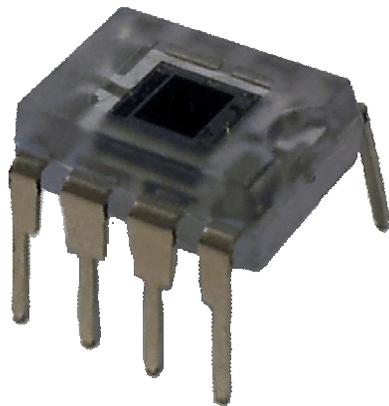
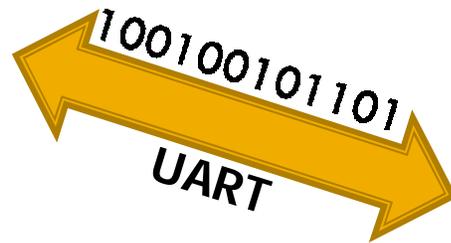


Light Sensor: TI OPT101

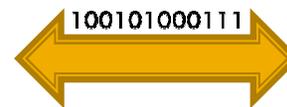
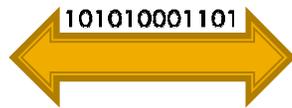
- Incredibly small monolithic photodiode
 - Measures 0.090 x 0.090 inches
- On-chip transimpedance amplifier
- Output voltage increases linearly with light intensity
- Necessary to convert from analog to digital signal within the CPU



Putting It Together



How Does Data Storage Work?



Non-Volatile Data Storage

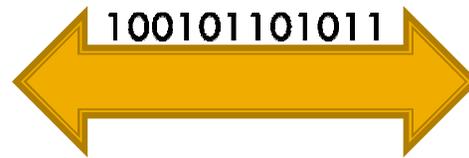
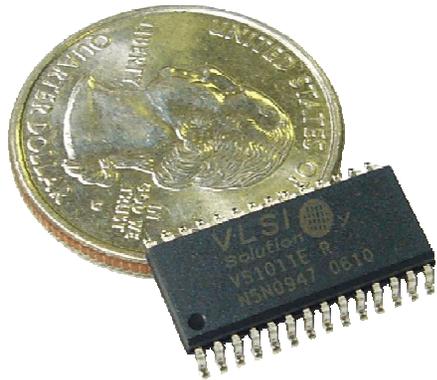
- 2GB SD Card
 - Provides local storage for music library
- SDRAM: Micron MT48LC4M16A2P
 - 128 Mb of temporary storage
 - Provides a buffer between the SD Card and the music decoder
 - General purpose memory access for all peripherals



Putting It Together

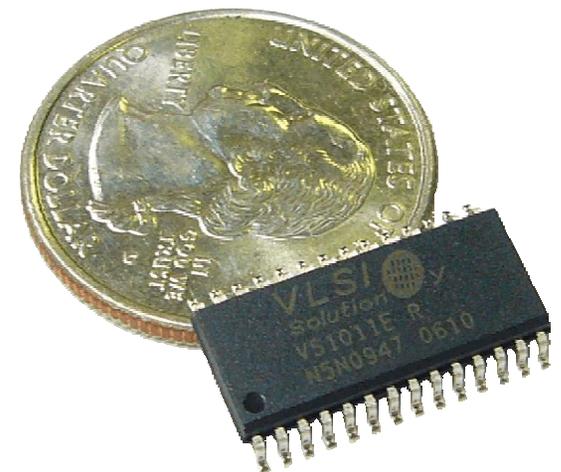


How Does Music Decoding Work?



Music Decoder: VLSI VS1011

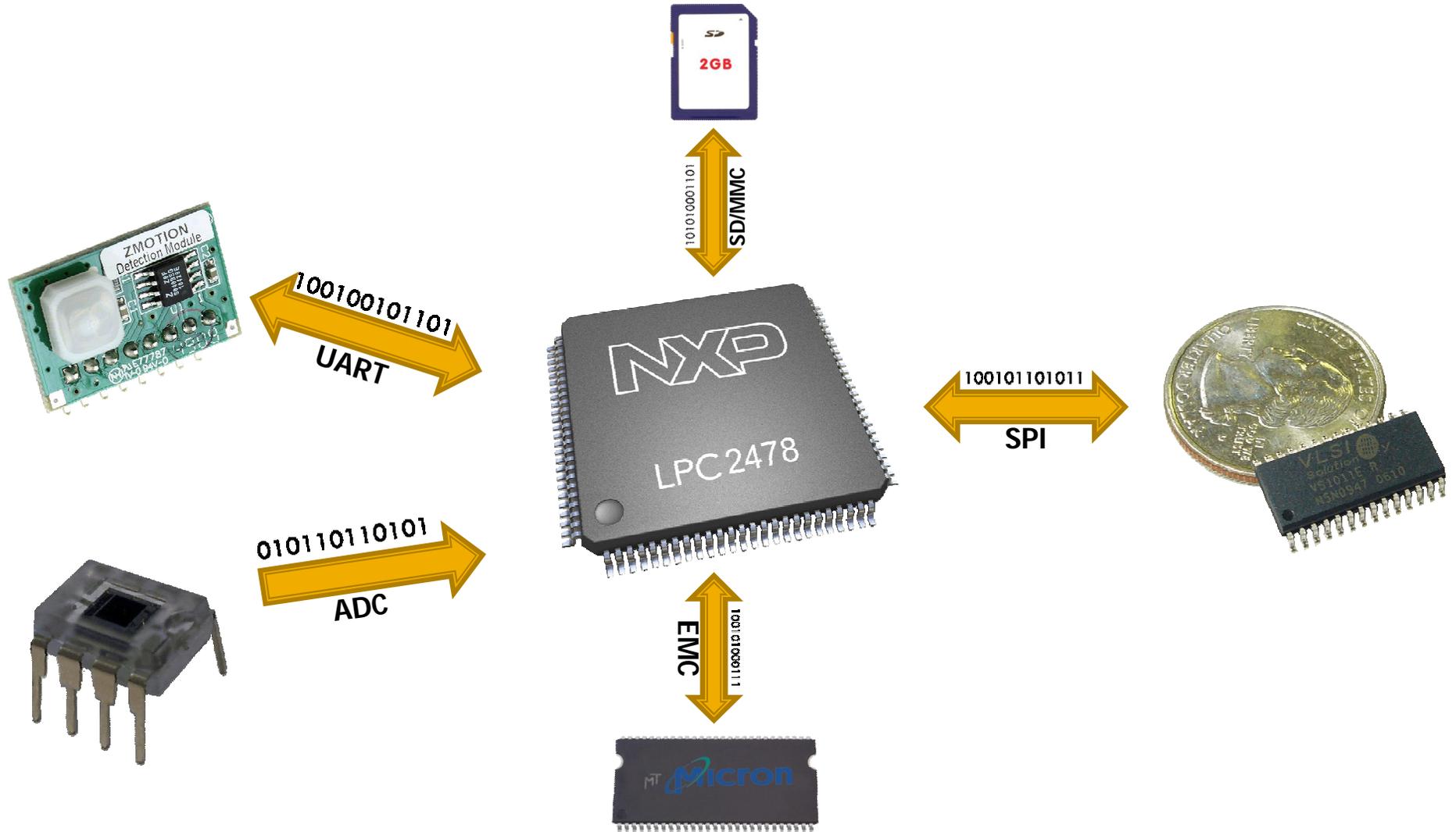
- High-performance, low-power DSP processor core VS DSP4
- High-quality oversampling variable-sample-rate stereo DAC
- Communicates via SPI interface
- Decodes various audio formats including:
 - WAV, PCM, MP1, MP2, MP3 (up to 320 kbit/s)



(Yes, it's that small)



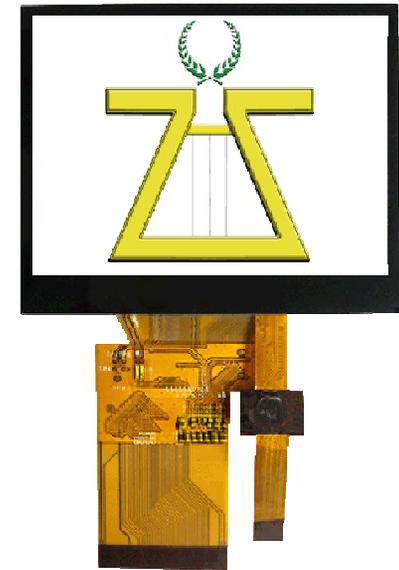
Putting It Together



How Does User Interface Work?

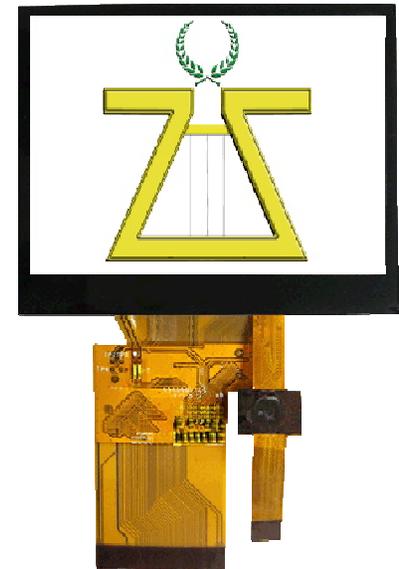


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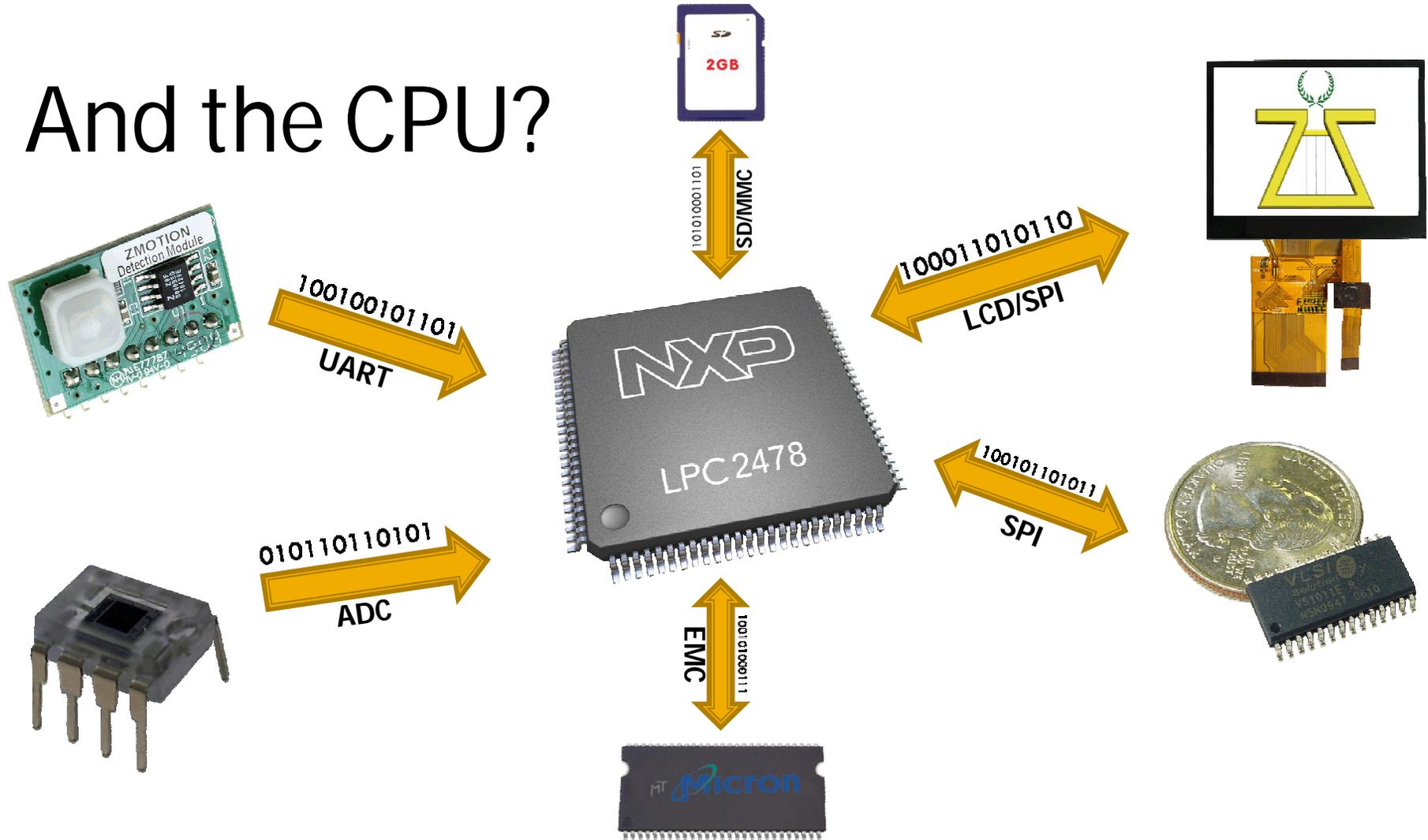
LCD Display: Newhaven NHD-3.5-320240M

- Displays current song information and device status
- Supports up to 320xRGBx240 resolution
- Easily readable thanks to embedded LED backlight
- 24-bit "truecolor" Parallel digital RGB interface (6.4MHz)
 - That's 16,777,216 colors!
- Capacitive Touch Panel with SPI controller



Putting It All Together

And the CPU?

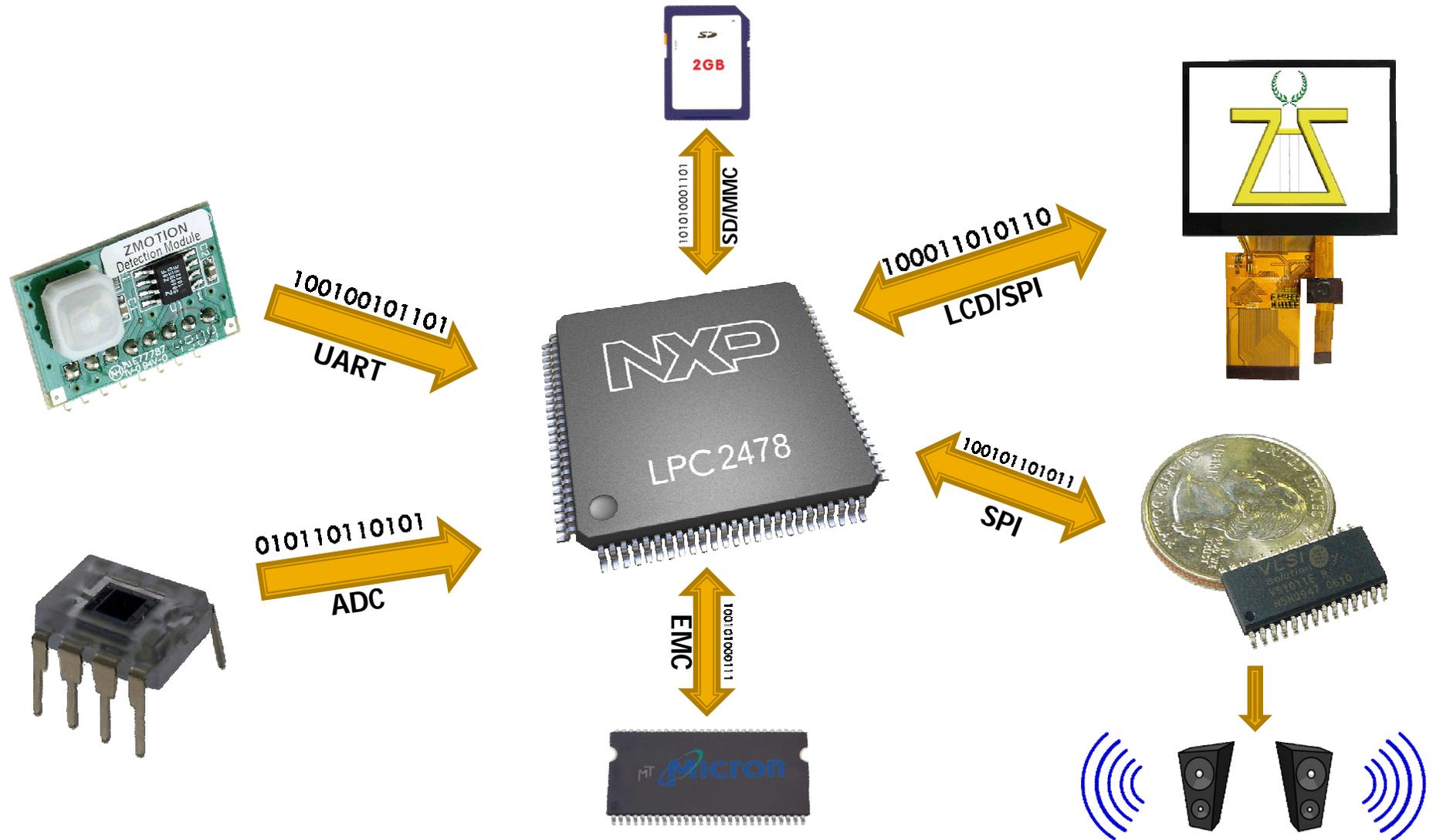


Central Processing Unit: NXP LPC2478

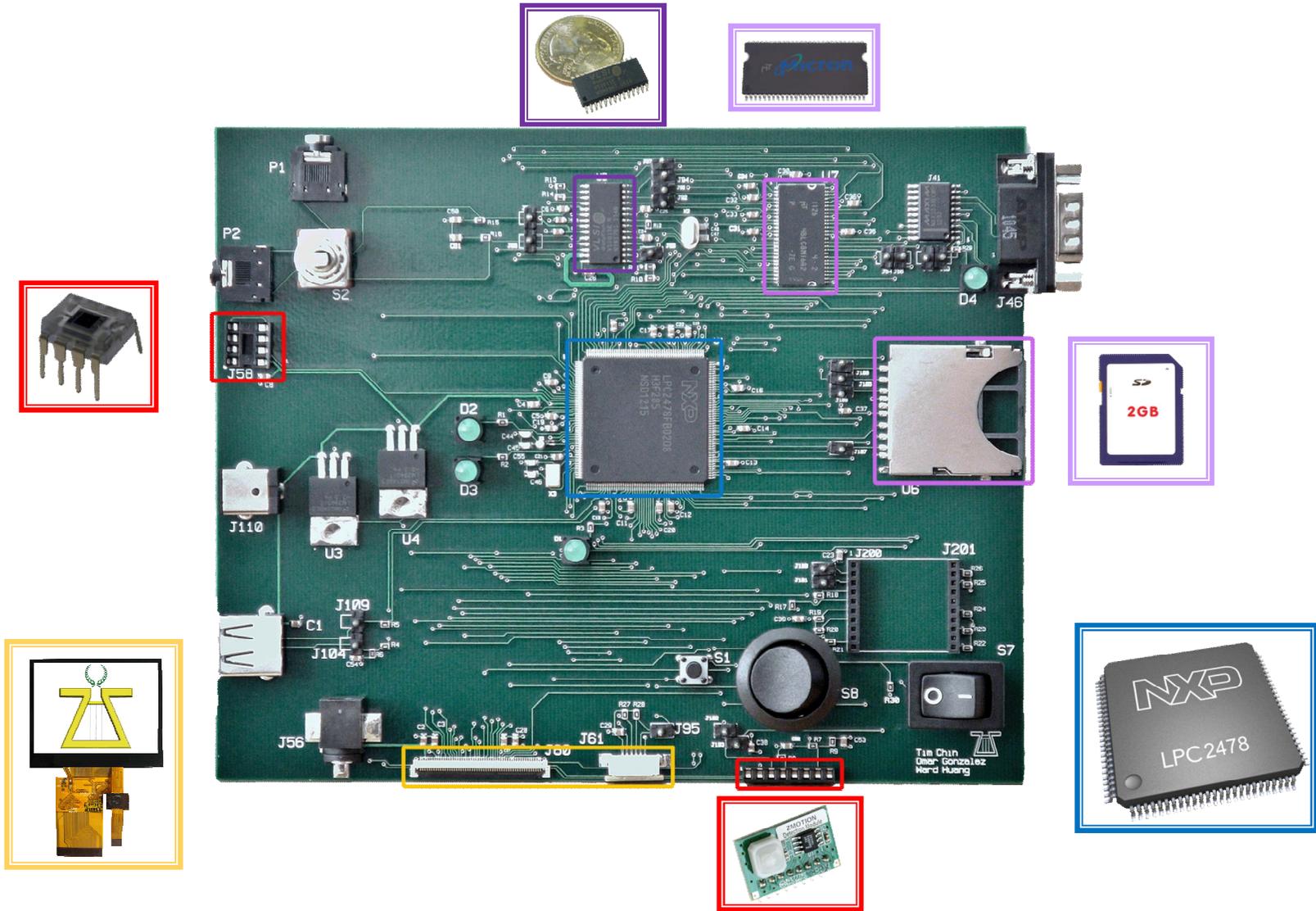
- Highly integrated microcontroller for a wide range of applications that require advanced communications and high quality graphic display
- 512 kB of on-chip high-speed flash memory
- LCD Controller, including support for TFT screens
- External Memory Controller provides support for synchronous dynamic memory devices
- SD/MMC memory card interface.



The Big Picture



Printed Circuit Board



Video Presentation



Words of Wisdom

- Start early, start early, start early...
- Read EVERYTHING
- Double check, triple check, quadruple check your connections
- Bring a sweater
 - Those nights get real cold



Special Thanks to...

Our tireless (and worrisome) leader: **Dr. John Johnson**
A better man than most, our TA: **Joseph Malcolm**



Thanks to Jorge Gonzalez