Project Description

- Music player that plays custom songs and playlists based on multiple factors including:
  - Lighting (artificial, natural, brightness)
  - Time of day
  - Weather
- Read from SD Card, Streaming music (Google music, maybe Pandora), Analog in/out
- Motion Detection to start playing when the user enters the room, autosleep due to inactivity (can be disabled)
- Touchscreen functionality with GUI for navigating songs and editing playlists/other information
- Additional Functionality
  - Android device enabled over WiFi (uses app with GUI to communicate)
  - USB connection for basic mp3 device (ideally ipod or android).
  - Integrated speakers
Applications

- Small, discreet, functional, all encompassing music player that has added functionality.
- Plays music automatically to set the tone of the room
- Useful in commercial practice as a consumer product
High Level Block Diagram

- CPU: NXP LPC-2478
- AtoD Converter (AUX in)
- Light Sensor: TEMT6200FX01
- Analog to Digital Converter
- Motion Sensor: Zmotion ZEPIR0AAS02MODG
- Music Decoder: VS 1053
- LCD Touchscreen: NHD 320240MF-ATXL-CTP
- SD Card Reader
- SDRAM: MT48LCB8M8A2P-6A
- WiFi: RN171XVW – I/RM
- Server?
- Android Device?
- USB
Responsibility

- **Tim**: Group leader, Software lead, networking, music
- **Omar**: Touchscreen, SDRAM, co-lead for board design
- **Ward**: Light/motion sensors, USB/SD, co-lead for board design
- **All**: Processor
Parts and Specifications

- **Music Decoder Chip - VS1053**
  - Ogg Vorbis / MP3 / AAC / WMA / FLAC / MIDI Audio Codec Chip
  - Bass and treble controls
  - Operates with a single 12-13 MHz or 24-26 MHz clock
  - Internal PLL clock multiplier
  - Low-power operation
  - Serial control, data interfaces
  - UART for debugging purposes
Parts and Specifications

- **Light Sensor Module - TEMT6200FX01**
  - +/-60° field of view
  - Supply voltage: 3.0 to 5.5VDC
  - Dimensions: 16(W) x 12(H) x 4(D)mm
  - Adapted to human eye responsivity
  - High photo sensitivity
  - Silicon NPN epitaxial planar phototransistor in a miniature transparent 0805 package for surface mounting
Parts and Specifications

- **LCD Touchscreen** – Newhaven Display - NHD-3.5-320240MF-ATXL#-CTP-1
  - 320xRGBx240 resolution
  - LED backlight
  - 24 bit RGB digital RGB interface (6.5MHz)
  - Capacitive Touch Panel with Controller
  - Serial I2C clock and data
Parts and Specifications

- **WiFi Module – RN171XVW-I/RM**
  - 8-Mbit flash memory and 128-Kbyte RAM, 2-Kbyte ROM, 2 Kbyte battery-backed memory
  - UART (1 Mbps host data rate) and SPI slave (2 Mbps host data rate) hardware interfaces
  - Real-time clock for wakeup and time stamping/data logging; auto-sleep and auto-wakeup modes

- **Network support:**
  - Supports ad hoc and infrastructure mode connections
  - Push-button WPS mode for easy network configuration
  - On-board TCP/IP stack
  - Over the air firmware upgrade (FTP) and data file upload support
  - Secure Wi-Fi authentication via WEP-128, WPA-PSK (TKIP), and WPA2-PSK (AES)
  - Configuration over UART or wireless interfaces using simple ASCII commands
  - Built in networking applications: DHCP client, DNS client, ARP, ICMP ping, FTP client, TELNET, HTTP, UDP, and TCP
Parts and Specifications

- **SDRAM - MT48LC8M8A2P-6A**
  - PC100- and PC133-compliant
  - Fully synchronous; all signals registered on positive edge of system clock
  - Internal, pipelined operation; column address can be changed every clock cycle
  - Single 3.3V ±0.3V power supply
  - Clock Rate 166 MHz
Parts and Specifications

- Motion Sensor – Zmotion ZEPIR0AAS02MODG
  - Small form factor – only 25.5 mm x 16.7 mm x 9.5 mm
  - 8-pin interface connector with two available orientations (right-angle and straight)
  - Wide 5m x 6m, 60-degree detection pattern
  - Simple hardware- or advanced serial (UART)-based configuration and interface
  - Adjustable sensitivity and output activation time and support for Ambient Light Sensor input
  - Unique Hyper Sense feature automatically increases sensitivity after motion is detected
  - SLEEP Mode for low-power applications
  - Minimal components ensure high reliability (no electrolytic capacitors)
  - Modify the application code to suite your own application requirements
  - 2.7V to 3.6V operation from 0°C to 70°C
Parts and Specifications

- SD Card Connector

  ![SD Card Connector PIN Assignment Table]

- USB Connector

  ![USB Connector Image]
Technology and IP Reuse

- LPC-2478 ARM7 CPU
- Roving Networks WiFi module
- Newhaven Touchscreen module
- Motion Sensor
- Light Sensor
Critical Design Elements

- **Music Player**
  - If the music functionality doesn’t work then we essentially have a big paperweight with a nice screen

- **Light sensor**
  - Necessary to choose specific songs/playlists

- **Touchscreen with GUI**
  - Necessary to interact with the device and change songs/settings

- **At least one form of non-volatile storage**
  - Need to be able to actually read music from storage, primarily looking at SD card. USB and WiFi are less essential
<table>
<thead>
<tr>
<th>Milestone</th>
<th>Date</th>
<th>Task</th>
<th>Start Date</th>
<th>End Date</th>
<th>Person Responsible</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>10/1/2012</td>
<td>Form Group</td>
<td>10/1/2012</td>
<td>10/5/2012</td>
<td>All</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Formulate Idea</td>
<td>10/1/2012</td>
<td>10/8/2012</td>
<td>All</td>
</tr>
<tr>
<td>Milestone #1</td>
<td>10/8/2012</td>
<td>Make block diagram</td>
<td>10/1/2012</td>
<td>10/8/2012</td>
<td>All</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Conceptual Drawing</td>
<td>10/1/2012</td>
<td>10/8/2012</td>
<td>All</td>
</tr>
<tr>
<td>Milestone #1</td>
<td>10/8/2012</td>
<td>Research: WiFi, Light Sensor</td>
<td>10/8/2012</td>
<td>10/11/2012</td>
<td>Tim</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Research: Motion Sensor</td>
<td>10/8/2012</td>
<td>10/11/2012</td>
<td>Omar</td>
</tr>
<tr>
<td>Milestone #1</td>
<td>10/8/2012</td>
<td>Research, Touchscreen</td>
<td>10/8/2012</td>
<td>10/11/2012</td>
<td>Ward</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Compile Milestone #2</td>
<td>10/10/2012</td>
<td>10/14/2012</td>
<td>All</td>
</tr>
<tr>
<td>Milestone #2</td>
<td>10/15/2012</td>
<td>Create IDR Package</td>
<td>10/16/2012</td>
<td>10/24/2012</td>
<td>All</td>
</tr>
<tr>
<td>Initial Design Review</td>
<td>10/24/2012</td>
<td>Gather Bill of Materials</td>
<td>10/24/2012</td>
<td>10/29/2012</td>
<td>All</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Gather all final datasheets</td>
<td>10/24/2012</td>
<td>10/29/2012</td>
<td>All</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Very detailed block diagram</td>
<td>10/26/2012</td>
<td>10/31/2012</td>
<td>All</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Figure out software, compilers,</td>
<td>10/24/2012</td>
<td>10/31/2012</td>
<td>Tim</td>
</tr>
<tr>
<td></td>
<td></td>
<td>networking system</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Figure out how to get data from</td>
<td>10/24/2012</td>
<td>10/31/2012</td>
<td>Ward</td>
</tr>
<tr>
<td></td>
<td></td>
<td>sensors and USB/SD card</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Figure out SDRAM, how to use</td>
<td>10/24/2012</td>
<td>10/31/2012</td>
<td>Omar</td>
</tr>
<tr>
<td></td>
<td></td>
<td>touchscreen</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Start board design</td>
<td>10/26/2012</td>
<td>10/31/2012</td>
<td>Omar and Ward</td>
</tr>
<tr>
<td>Milestone #3</td>
<td>10/31/2012</td>
<td>Compile Milestone #3</td>
<td>10/29/2012</td>
<td>10/31/2012</td>
<td>All</td>
</tr>
<tr>
<td>Preliminary Design Review</td>
<td>11/5/2012</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Milestone #4</td>
<td>11/28/2012</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Critical Design Review</td>
<td>12/3/2012</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Milestone #5</td>
<td>12/7/2012</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
• Questions?
• Comments?
• Concerns?