ECE 492 - Computer Engineering Design Project

Network Controllable MP3 Player

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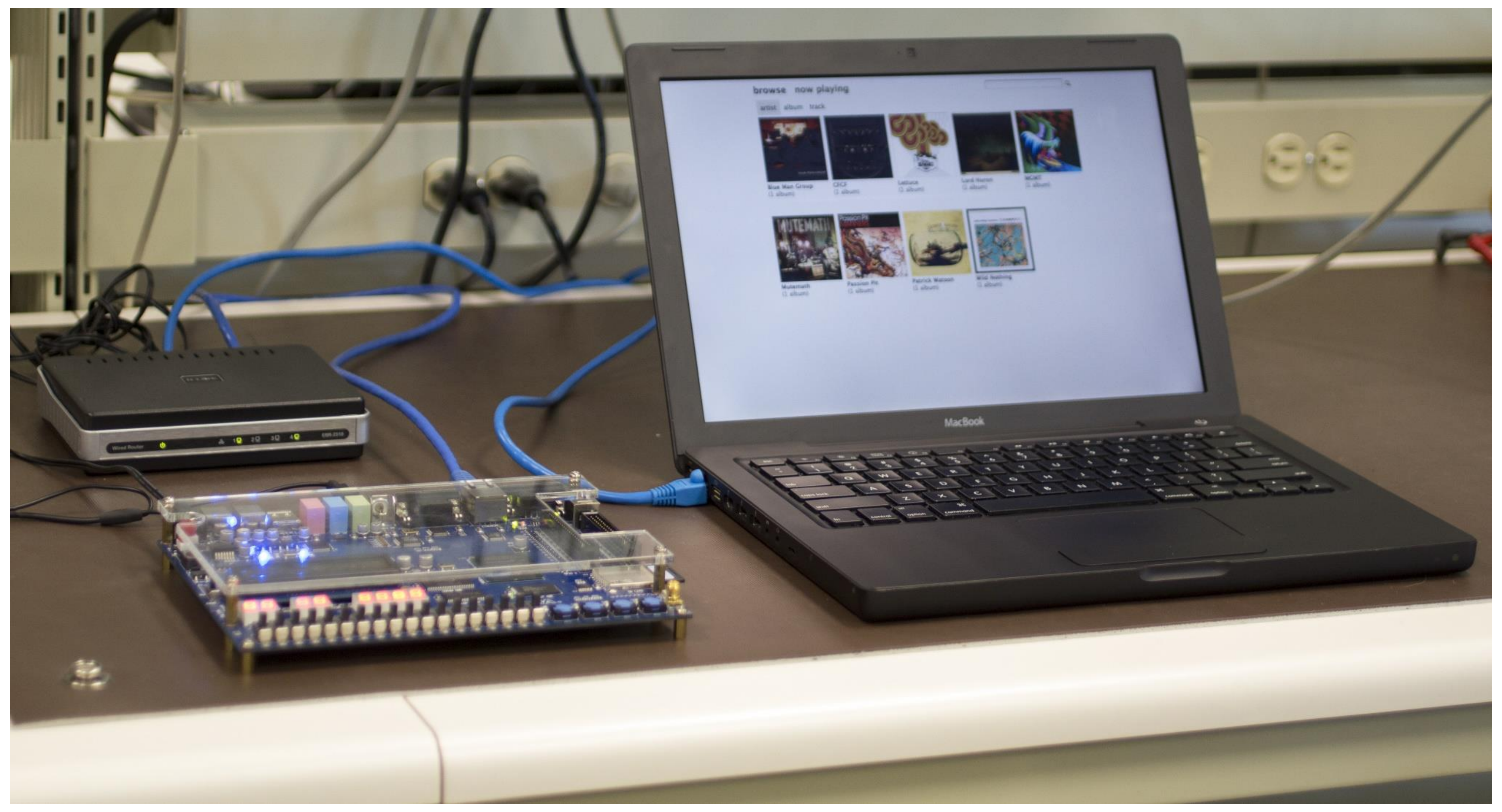
Overview

The goal for this project was to design a user-friendly MP3 player that can be controlled from any network connected device in your home. MP3 files stored on an SD card are processed for ID3 track metadata. This information is presented to users through a web server that serves the main web page, scripts, and API requests for querying the player's state, or sending controls. During playback, audio samples are decoded in real time out to the audio codec.

Features

- Reads FAT32 file system formatted SD cards for easy interoperability with most other devices and operating systems
- Parses ID3 track metadata to determine artist, album, track title, and other information associated with an MP3 file
- Decodes and plays MP3 files with any variable or constant bitrate
- Ethernet network connection and HTTP web server provide control through a web browser on any computer in the network
- Supports hot swapping of SD cards to switch music libraries on the fly. Clients automatically update without requiring a refresh.



MP3 File Processing

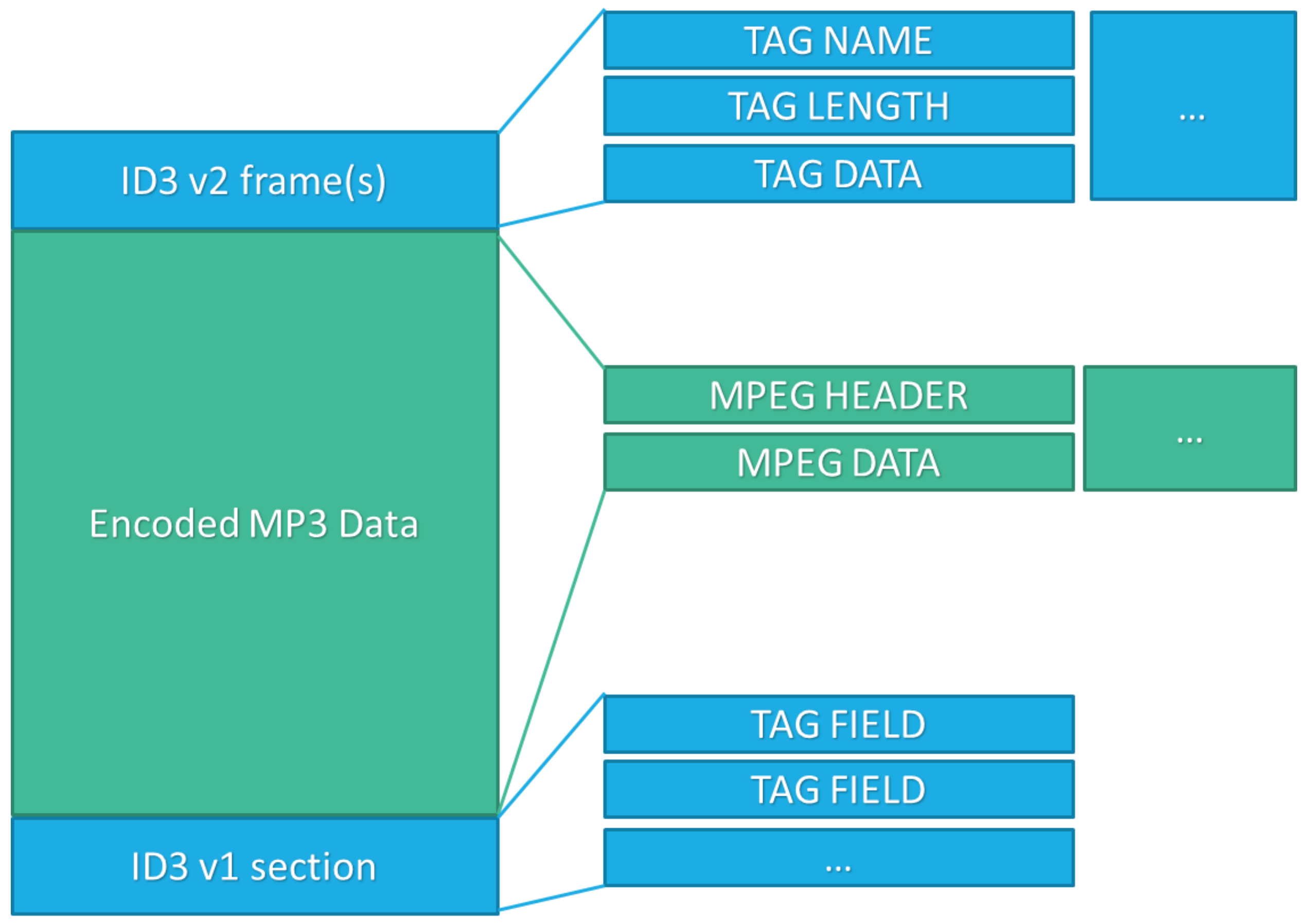


Fig. 1: Structure of an MP3 file

Users expect that a modern MP3 player should display the track metadata stored in the file in the form of ID3 tags. Our player parses this information from files as it indexes the SD card, and exposes it through the user interface for intuitive browsing based on artists, albums, or tracks, rather than filenames.

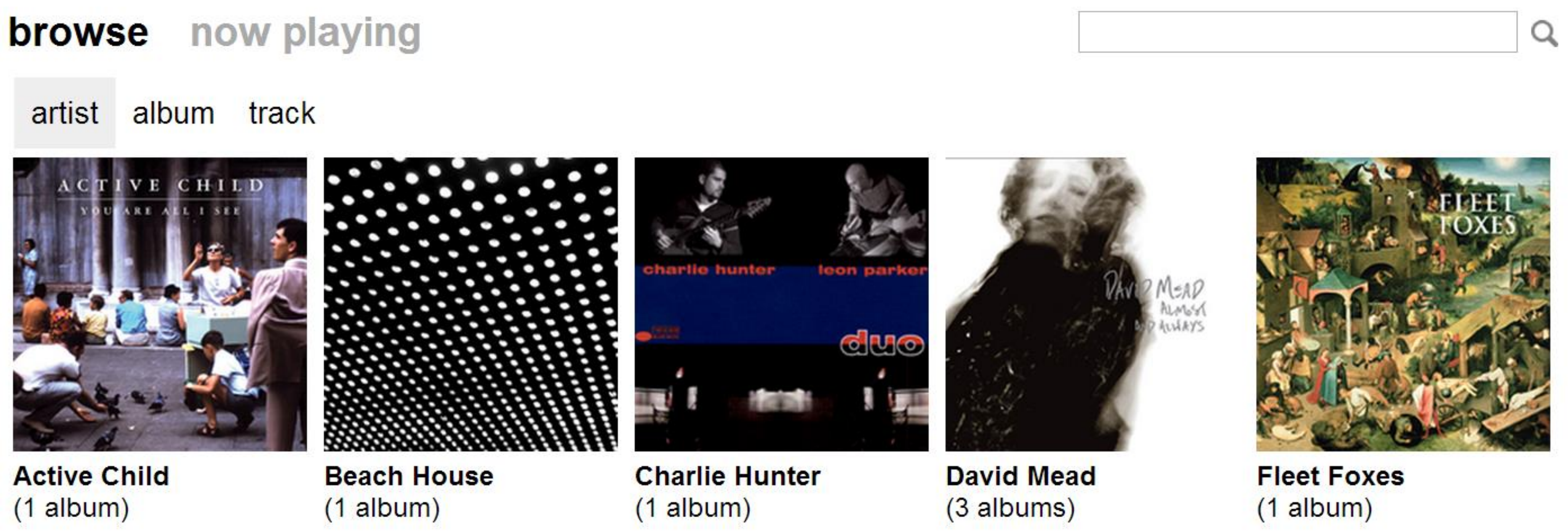
MPEG data is decoded through the use of the open source library libmad. Constant and variable bit rates are supported for the industry standard audio sample rate of 44.1 kHz. Decoding and playback performance was aided through buffering SD card reading, and buffering of audio codec output in a hardware FIFO. Audio decoding is 54% faster than real-time (on average), allowing extra processing time to be used to run the web server.

Client-Server Architecture

The web server responds to HTTP GET requests for the main index HTML page, images, and JavaScript scripts. Client-side JavaScript then makes asynchronous POST requests to the server to query for the music library, send requests to control the player, and a regular status update to remain synchronized with the player in the event of changes made to the board physically (an SD card swap for example), or through another network connected client.

User Interface

- Modern, intuitive, fluid, and responsive
- Asynchronous download of album artwork and artist information for millions of songs using the last.fm database
- Instant search for artists, albums, or tracks
- State of the player synchronizes across multiple connected clients
- User interface updates automatically to respond to events as diversified as another client changing the volume, or the change to a different SD card



Active Child
(1 album)

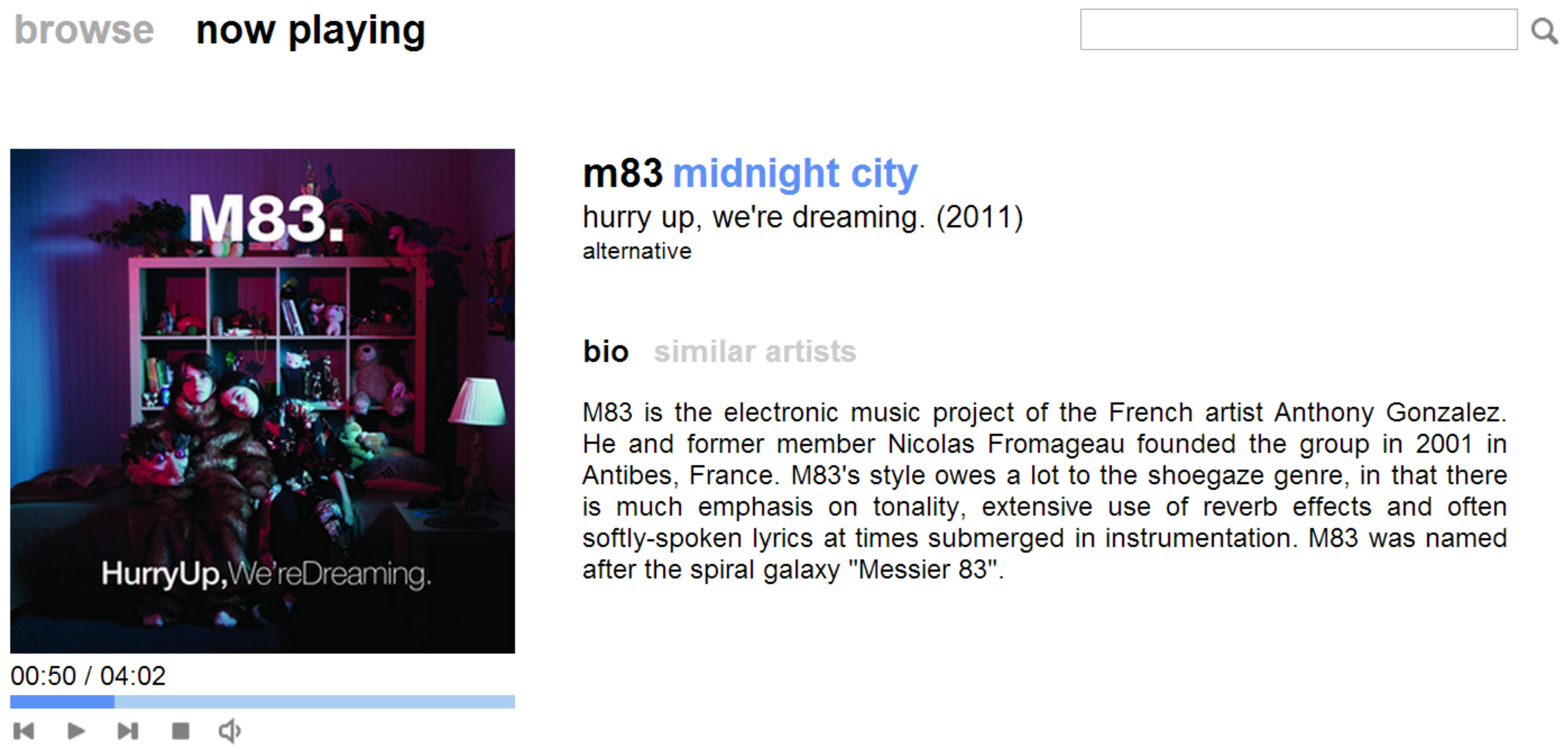
Beach House
(1 album)

Charlie Hunter
(1 album)

David Mead
(3 albums)

Fleet Foxes
(1 album)

Fig. 2: Browsing MP3 files on the SD card



m83 midnight city
hurry up, we're dreaming. (2011)
alternative

M83 is the electronic music project of the French artist Anthony Gonzalez. He and former member Nicolas Fromageau founded the group in 2001 in Antibes, France. M83's style owes a lot to the shoegaze genre, in that there is much emphasis on tonality, extensive use of reverb effects and often softly-spoken lyrics at times submerged in instrumentation. M83 was named after the spiral galaxy "Messier 83".

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Fig. 3: Track playback interface

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