2016

Software Architecture Document

GROUP 16

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1. Introduction

1.1 Purpose

The purpose of this document is to provide a comprehensive overview of the architectural framework from both a hardware and software perspective of the CD to digital copy music converter system. The following documentation will give a more detailed understanding into the inner workings of this project and will depict the capabilities and functions designed for the music system. The product will be a cd player that will be able to convert user's CDs into digital form and store them on an internal HDD where they can be stored, played back, and backed up for long periods of time. The system will allow users to retire their old collection of CDs which take up an ample amount of space, and to instead have a portable system where all of their music is stored safely and with high quality. This architecture outline will cover the entirety of the hardware and software components of system that is to be designed.

1.2 Scope

The device to be constructed is an all-in one digital system that is able to store thousands of songs from different CDs and vinyl to an internal HDD. More specifically, this system provides a way for users to retire their old CD collection which takes up a lot of space, and be able to store all their songs and playlists into one machine. The system will allow for playlist creations, CD ripping, music back-ups, music storage and playback. This system is designed to offer convenience to the user and ease of use.

1.3 Definitions, Acronyms and Abbreviations

This section contains some definitions of different components of software that will be used in the digital CD player system.

- Database: Ordering and storing data in tables that can all be uniquely identified and retrieved from
- MP3 – Digital music file which compresses music and stores its attributes (Artist, name, etc.)
- Playlist: A collection of songs which may not be from the same artists or album. Playlists are custom made from songs by the user
- HDD: Hard Disk Drive. A magnetic storage medium.
- SSD: Solid State Drive. A flash memory storage medium

1.4 References

2. Architectural Representation

The different views in this case are: Design View, Process View, Use Case View, Logical View, Deployment View and Implementation View.

Design View:
    User: Designers of aesthetics.
    Functions: To make the product more marketable.

Process View:
    User: Designers of user interface.
    Functions: To make the product easy to use for customer.

Use Case View:
    User: All stakeholder of the product including the customer.
    Functions: To make anyone with an investment in the product pleased.

Logical View:
    User: Developers or Engineers
    Functions: The processor and operating system of the product.

Deployment View:
    User: Packing and shipping managers.
    Functions: To make the product as cost effective and efficient to ship as possible.

Implementation View:
    User: Programmers
    Functions: The software involved.

3. Architectural Goals and Constraints

Some key requirements of the system are as follows.

1. The system must be able to transfer data from a CD Digital Audio Disk, to an onboard hard disk drive, reading at high-quality and quickly.
2. The system must also be able to retrieve stored audio files from the HDD and output it to an auxiliary audio port.
3. The system must have user-interface allowing for full control including Read, Play, Change source, and navigate a file folder system.
4. The system must be able to also output data to a removable storage drive such as an SD Card, USB Thumb Drive, and an external Solid State Drive in an enclosure.
5. The system must be able to play audio in real time from the CD drive, in addition to the audio retrieval from the onboard storage media.
6. Retrieval and storage of data will hinder upon the growth of the database. Efficient sorting algorithms must be designed and implemented to ensure fast retrieval of data.
7. A NoSQL database approach can be used to replace a SQL database. NoSQL is a new and popular database system which gained its popularity in systems that have very large databases.
8. The LAME MP3 encoder must be implemented into the system to allow for conversion from CD music format to MP3 format
9. File conversion must be done efficiently; Files must be saved to a temporary location, converted to MP3 format and then saved to the database which requires extra space
10. Database must be backed-up at regular intervals for safety
11. Controlling music playback through software, for functions such as playing, stopping, or skipping tracks

4. System Views

The system involves multiple hardware and software components, working together. The System Views describe each of the individual facets of the product's architecture.

4.1. System hardware architecture

This interaction chart represents the various interactions between a given hardware peripheral as well as the type of data flowing as input or output.
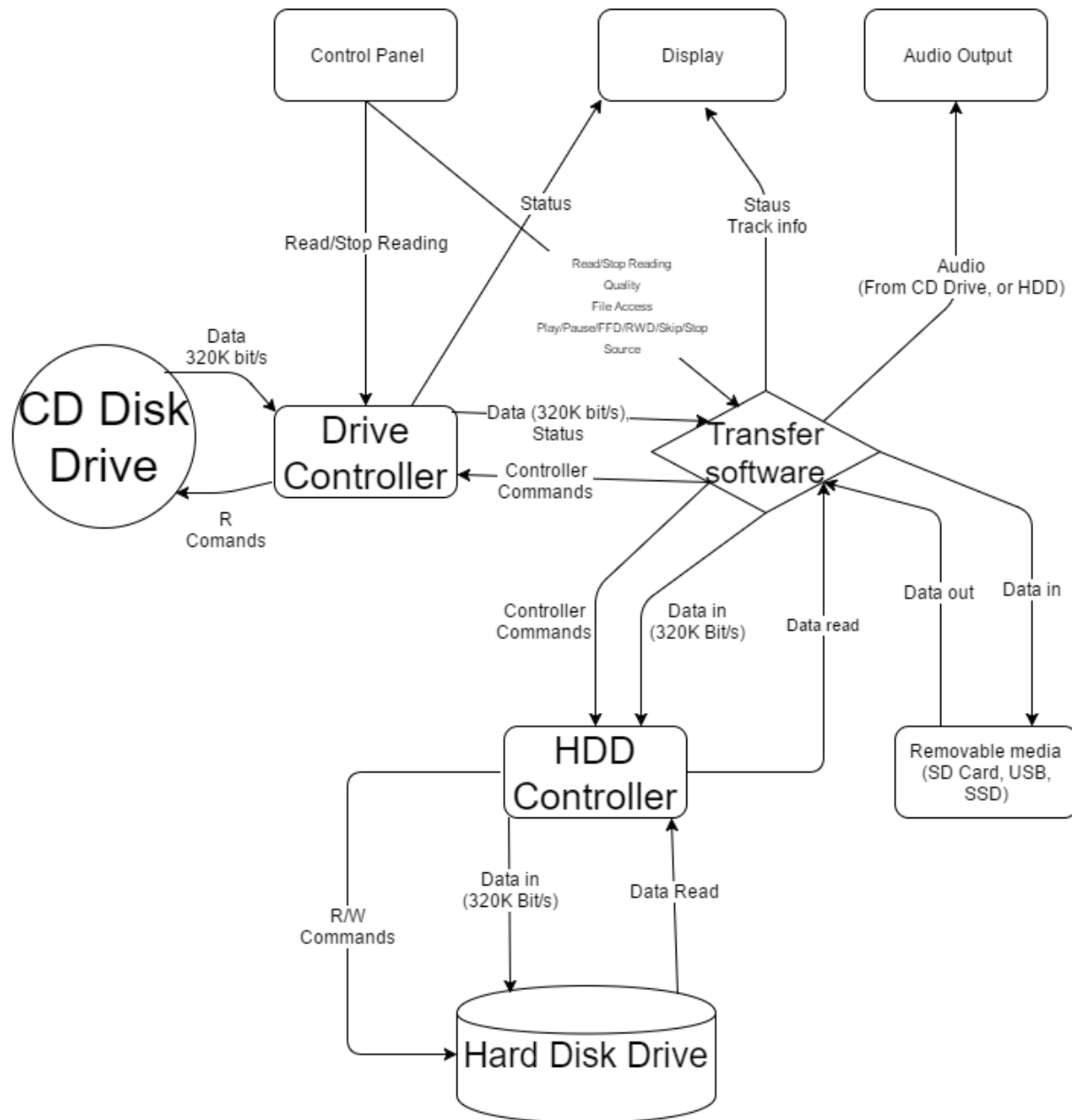
4.1.1. CD Disk Drive

Brief Description: A CD drive capable of reading CD Audio Disks at 320K bit/s.

4.1.2. Drive Controller

The control board used to control the spin and read of the CD drive, passing through data and status, with inputs for control.

4.1.3. Control Panel

Physical interface with buttons for all necessary inputs needed to control the system. Controls include:
1. Read/Stop Reading
2. Quality, File Access
3. Play/Pause/FFD/RWD/Skip/Stop
4. Source.

4.1.4. Display

A display capable of text and numerical output. LCD matrix.

4.1.5. Audio Output

A 3.5mm TRS audio jack, used to output audio from CD being read, and audio being read from storage systems attached to or internal to the system.

4.1.6. Transfer Software

A microprocessor or imbedded computer which handles data transfer between the drives, and allows for file system write and access.

4.1.7. HDD Controller

Similar to the Drive Controller, but is used to interface data and controls to the Hard Disk Drive (HDD). Handles read and write duty, and can index the HDD.
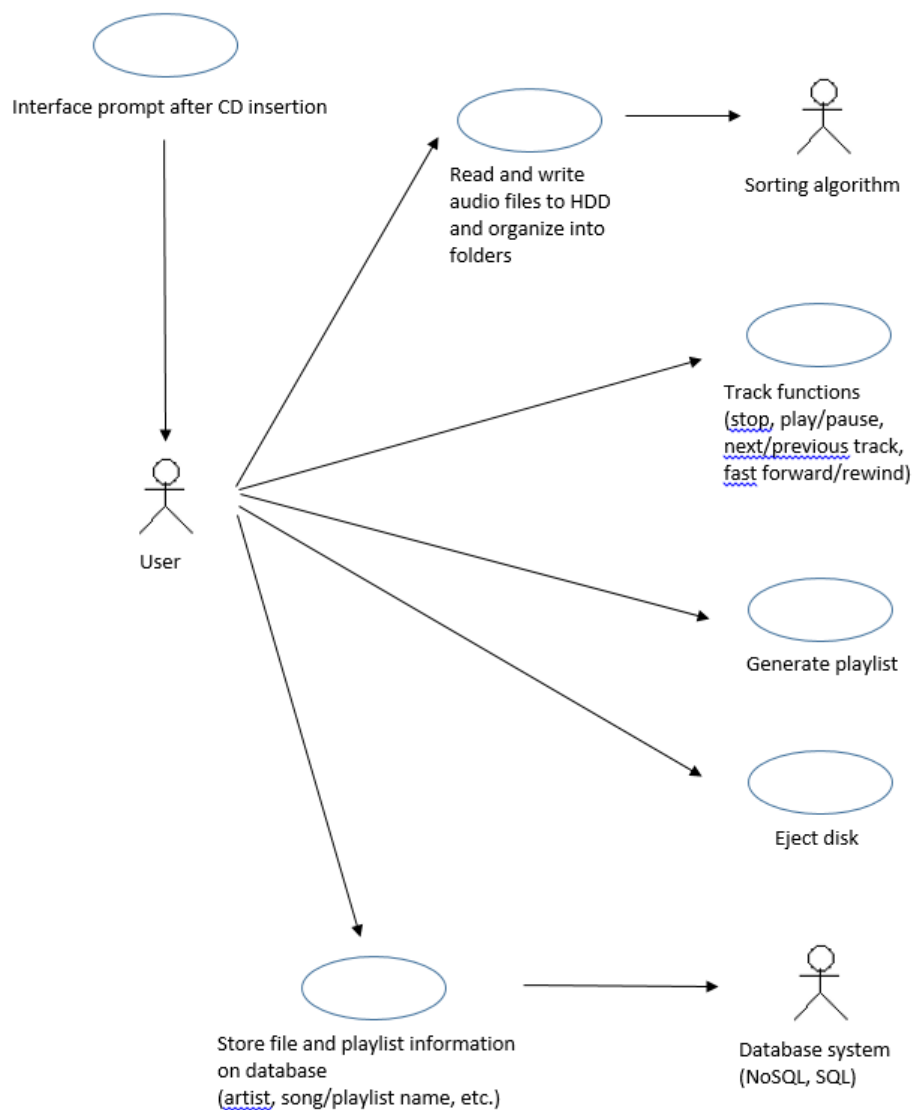
4.1.8. Hard Disk Drive

An internal magnetic storage drive, can be read from or written to.

4.1.9. Removable Media

An additional interface for external drives, can interface with SD Cards, USB Thumb Drives and Solid State Drives via external drive enclosures (Sold Separately)

4.2 - Software Interface User Interaction

This diagram depicts the explicit features available to the user from the software perspective.

4.2.1 – Burning Audio Files to Hard Disk Drive

This functionality enables the user to initiate the device to read the audio files and transfer them to the interior hard drive. In addition, an implicit function the user will not be able to see behind the scenes is organization of their files into neat folders with the use of a sorting algorithm (insertion sort, merge sort, quicksort, bubble sort, etc.).

4.2.2 – Track Functions

A very straightforward capability that includes a subset of functions such as playback and pausing a selected track, stop, fast forward/rewind, and skipping to a previous/next file.

4.2.3 – Generate Playlists

Based on a selection of user selected tracks, the software will be able to compile a playlist where the information can also be stored – explained below.

4.2.4 – Store File and Playlist Information

With the use of most likely a relational database such as SQL, the user will have the option to store their audio file information such as artist names, track names, album names, etc. as well as playlist information – of course, the semantics of storing this data will be an implicit function (the user will not need to know how to use the database).

5. Size and Performance

The chosen software architecture supports the storage of the audio files and the playback requirements, as available in the Software Requirements Specification document.

1) The software of this device will be programmed to support up to 5 000 CD's or approximately 50 000 audio files. The music will be able to playback immediately in approximately 2 seconds latency.

2) The latency of searching a song is also very minimalistic in which it will be approximately 5 seconds maximum for looking through the library of music.

3) The consumption of the hard disk in the device will vary when the user decides to delete items immediately approximately 5 seconds latency for each deleted song.

4) The system will have immediate access to the music with 2-5 second latency whatsoever.

5) This software will be approximately 50 000 lines of code.

6) The software designed for such a product will require a space of 20 MB of data and will require approximately 32 MB of RAM.

7) The system will take approximately 4-8 minutes to rip the CD onto the hard drive of the device.

8) The system will take approximately 10 seconds to 20 seconds to upload each song from the external USB to the hard drive of the device.

6. Quality

The chosen software architecture supports the storage of the audio files and the playback requirements, as available in the Software Requirements Specification document.

1) For users that are using this software on a desktop interface, the minimum requirements of the operating system should be Windows 7/8 compliant.

2) The user interface of the software shall be designed for ease-of-use and shall be appropriate for the target audience of CD users who wish to RIP the CD's onto a hard drive. The ease of use will provide users for the ability of quick start up and require no additional assistance.

3) For users who still struggle with the software and hardware portions of the device will have to access the online help given on the web and/or an instruction manual provided in the packaging of the hardware. These manuals will include instructions, troubleshooting tips, quick startup and acronym definitions to help the user/client in any way possible.

4) There will be little to no software or hardware failure in the given product.

5) The system will always be running for the client as long as the product is in use.

6) Updates for the device will be available on the web as a downloadable service. This feature enables users to have access to easy system upgrades.