1. Introduction

1.1. Goals and Requirements
This document addresses the following goals and functional requirements for designing a simulated portable media player.
- Access audio collection
- Create a custom playlist
- Remove existing playlist
- Play tracks from playlist
- Delete track from playlist
- Add tracks to playlist
- Shuffle playlist
- Browse by artist, title and album
- Repeat track
- Search for track
- Display track information

1.2. Product Scope
This product will be used by individuals who need to manage, store and listen to their music files on a portable device. The objective is to design a simple, intuitive interface with limited screen estate for managing music content.

1.3. References
2. Design Overview

2.1. System Overview
This simulated portable media player will be implemented as a Java Applet using a client/server architecture (Figure 1).

![Client/server architecture](image)

Figure 1: Client/server architecture

2.2. General Constraints
The player’s display area is limited to 320x240 pixel screen size and 320x240 pixels for interactive controls [3].
2.3. Discussion of Alternative Designs
The following section describes portable media designs for Apple’s iPod, Creative Zen Vision M and Sony’s video mp3 player.

2.3.1. iPod Classic
Figure 2 below illustrates the iPod’s button controls.

![Apple iPod’s button controls](image)

**Figure 2: Apple iPod’s button controls [4]**

iPod features its signature click wheel for selecting Menu options (Figure 3) by simply moving a thumb around the wheel. Not much of an affordance since a 360 degrees rotation does not map well with one-dimensional up-down motion for a menu list. The center button is used as a Select option but is not labeled. The remaining button controls are simple and compact and have intuitive mappings. In particular, the iPod has managed to provide all its functionality with the use of just five buttons following George Miller’s 7±2 magic number principle for the number of items that can be held in short-term memory at any time [6].
iPod offers custom playlists (Figure 3) by allowing any track to be selected with the Center button and places those tracks in the “On the Go” menu. Users can save this playlist but cannot edit the playlist afterwards e.g. add songs, remove songs. In addition, iPod does not afford an easy Repeat button during song playback. Instead, the Previous/Rewind button must be selected after a song completes.

2.3.2. Creative Zen Vision M
The Creative Zen Vision M video mp3 player has (Figure 4) has a vertical touch pad that maps exactly with vertical menu lists and provides a more accurate conceptual model for navigating the menus.

However the Previous/Rewind and Next/Fast Forward buttons are barely visible and very small and are located on the left and right edges of the vertical touch pad respectively.
This design does not correlate well with Fitt’s Law which states that the time to acquire a target is a function of the distance to and size of the target [8]. Additionally four buttons are provided where only the Play/Pause button provides affordance. The Options button is the most cryptic and is used to provide additional options for managing playlists e.g. add a track to the “Now Playing” folder (which is similar to the iPod’s “On the Go” folder). In fact, these buttons break the traditional conceptual model for having play, fast forward and rewind buttons as main focal buttons that I decided not to read the remaining chapters of this manual [9].

2.3.3. Sony’s A810 Video mp3 player

![Figure 5: Sony’s A810 Series](image)

Sony’s player includes play, fast forward, rewind and pause options which closely fit with the traditional conceptual model for a media player (Figure 5). Seven buttons are provided and fit within George Miller’s 7±2 principle. The image icons (instead of menu options) provide good visibility for all nine options thus preventing the need for scrolling through menu items. Five of these options provide good mapping with respect to their functionality: search, music library, video library, photos and playlist. However, the need for the Back button is unclear.
2.3.4. Zune mp3 player

Zune (Figure 6) is Microsoft’s version which, in addition to features for playing media, includes a social network for sharing media content with other Zunes in close range. The interface consists of seven buttons, five of which are invisible with no labels. At first glance, the black circle looks much like Apple’s signature click wheel (poor affordance) but instead works by clicking four cardinal points of the wheel (north, east, west and south) for scrolling through the menus. In addition, the center acts as an OK button. The remaining two buttons are the play/pause and Back button for accessing previous screens. The screen size is large compared to the control area and allows a larger viewing area than the other players which is definitely an asset for viewing personal videos.
3. Class Diagram

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ControlButtons
- up: JButton
- down: JButton
- left: JButton
- right: JButton
- selectPlay: JButton

BasePanel
- controlButtons: ControlsButtons

ActionListener

PlayerMenu
- layoutManager: LayoutManager
- listBox: JList

PlaylistNameForm
- playlistName: JTextField
- alphabet: String[]

TracksMenu
- playlist: Playlist
- trackList: JList

PlayListMenu
- listBox: JList

CardLayoutPanel
- playerMenuPanel: PlayerMenu
- playlistNameForm: PlaylistNameForm
- tracksMenu: TracksMenu
- playlistMenu: PlayListMenu
- trackDisplayPanel: TrackDisplay

MediaPlayer
- playlistCollection: PlaylistCollection
+ search(playlist: Playlist): Track
+ browse(type: string, playlist: Playlist): List<Track>
+ shuffle(playlist: Playlist): Playlist

PlaylistCollection
- playlists: List<Playlist>
  + addPlaylist(playlist: Playlist): void
  + removePlaylist(): Playlist

Playlist
- tracks: List<Track>
- playlistName: String
  + shuffle(): List<Track>
  + removeTrack(song: Track): void
  + addTrack(song: Track): void
  + play(): void
  + getSize(): int

Track
- title: String
- artist: String
- album: String
- url: String
```
4. User Interface Design

This section illustrates the user interface for each use case and elaborates on the design decisions for the simulated portable media player. Since participants from my usability study [3] used their media players solely for listening to audio and particularly music, this interface design focuses mainly on the audio features.

The control area consists of seven buttons (Figure 7). Four are clearly labeled directional buttons for navigating the menus, the center button for play/pause and select depending on the context menu, and the two outlier buttons – the left button for accessing the menu and the right button for repeating a track. This repeat button was exclusively placed in lieu of a menu feature since participants from this study mainly used their media players for jogging or exercise and participant #3 wanted a quick and easily accessible option for repeating a track. The buttons were made to fill the entire control area so as to take advantage of Fitt’s Law which states that the time to acquire a target is a function of the distance to and size of the target [6].

![Figure 7: Control buttons for simulated media player](image)

All participants desired a need to manage their music content by using playlists to vary the songs that were played and also for organizing their audio collection. The first menu screen in this design thus places “Playlists” as the first option on the menu. The second important feature mentioned by participants was the need to shuffle the same music playlist each time. Browse and Search were less used features and hence placed as the remaining two items on the menu. By organizing the menu based on usage, this design hopes to increase efficiency of use.

The Browse option immediately starts browsing by track title. Views can be easily changed by clicking on the left and right arrow buttons for browsing by artist and album. Among participants, track title was the most frequently used metadata for locating music. On the Browse menu, when an album is selected, all songs from that album are played. Navigating by each track is also available by selecting the arrow buttons to change views.
By default, the “all” playlist is created by the media player. This playlist contains all songs stored on the music player. Participant #4 expressed a clear need for shuffling all music content easily. In addition, participant #3 did not like the inflexibility for changing playlists on his iPod hence a separate submenu for adding and deleting tracks was provided. Tracks can be added based on title, artist or album. The Browse option previously described is the interface used to select these tracks.

Participants can also name their playlists for easy recognition. An alphabet soft control is used to input text using the four navigation buttons. During playback, songs can be rated using the Menu button. This selection does not stop track playback.

During track playback, the display shows title, artist and album in that order. Participants in this study used these three fields mainly to locate music. In addition, the remaining time for song to complete is shown as well as the track number and rating for this song.

The Use Case sections to follow describe these interactions in detail with appropriate screenshots.

4.1. Use Case: Access Audio Collection
1. User selects power on feature.
2. Media player shows first screen with audio content presented in a menu: browse options and create custom playlists (Figure 8).

![Figure 8: Media Player menu](image)

4.2. Use Case: Create a playlist
1. User selects Playlist option from menu.
2. Media player returns sub-menu containing ‘Create playlist’ option (Figure 9).

![Playlist Menu]

- Begin Playlist
- Change Playlist
- Create Playlist
- Remove Playlist

Figure 9: Playlist menu

3. User selects ‘Create playlist’ option.
4. Media player prompts for name of playlist.
5. User enters name for playlist (Figure 10).
6. Media player displays list of song/track titles.

Figure 10: Entering playlist name

Figure 11: Selecting tracks for custom playlist
7. User selects song/track titles to add (Figure 11).
8. Media player adds songs to playlist.

4.3. Use Case: Delete playlist
1. User selects Playlist option from menu.
2. Media player returns sub-menu containing ‘Remove playlist’ option (Figure 12).

3. User selects ‘Remove playlist’ option.
4. Media player requests confirmation.
5. User confirms Yes/No/Cancel.
6. Media player deletes playlist.

4.4. Use Case: Access songs from custom playlist
1. User selects Playlist option from menu.
2. Media player returns sub-menu containing “Begin playlist” (Figure 13).
Figure 13: Selecting ‘Begin Playlist’ from the Playlist Menu

4. Media player displays all custom playlists (Figure 14).

Figure 14: Displaying custom playlists
5. User selects which playlist.
6. Media player plays each song from playlist.

4.5. **Use Case: Delete song from playlist**
1. User selects Playlist option from menu.
2. Media player returns sub-menu.
3. User selects ‘Change playlist’ option (Figure 15).

![Figure 15: Change Playlist](image)

4. Media player displays all playlists
5. User selects name of playlist to edit
6. Media player shows sub-menu containing ‘Remove track’ option (Figure 16).
7. User selects ‘Remove track’ option
8. Media player displays all song/track titles for that playlist.
9. User selects track to remove.
10. Media player requests confirmation.
11. User confirms Yes/No/Cancel.
10. Media player confirms track deleted.

4.6. **Use Case: Add song to playlist**
1. User selects Playlist option from menu.
2. Media player returns sub-menu.
3. User selects ‘Change playlist’ option.
4. Media player displays all playlists.
5. User selects name of playlist to edit.
6. Media player shows sub-menu containing ‘Add track’ option (Figure 17).
7. User selects ‘Add track’ option.
8. Media player shows all song/track titles from audio collection (Figure 18).

10. Media player adds song to playlist (dialog box shows confirmation).

4.7. Use Case: Shuffle playlist
1. User selects Shuffle option from main menu (Figure 19).

Figure 19: Selecting Shuffle menu option

2. Media player returns all playlists.
3. User selects which playlist to shuffle.
4. Media player shuffles songs randomly and begins playlist.

4.8. Use Case: Browse by artist/author
1. User selects ‘Browse’ option from menu (Figure 20).
2. Media player shows all tracks in alphabetical order.
3. User selects right arrow button.
4. Media player shows all artists (Figure 21).

![Figure 20: Selecting Browse menu option](image)

![Figure 21: Browse by Artist](image)
4.9. Use Case: Browse by album
1. User selects ‘Browse’ option from menu.
2. Media player shows all tracks in alphabetical order.
3. User selects right arrow button twice.
4. Media player shows all albums in alphabetical order (Figure 22).

![Browse by Album](image)

Figure 22: Browse by Album

5. User selects specific albums.
6. Media player shows all songs/tracks from album/book.
7. User selects specific song/track to play.
8. Media player plays song/track selected.

4.10. Use Case: Browse by song/track title
1. User selects ‘Browse’ option from menu.
2. Media player shows all tracks in alphabetical order.
5. User selects specific song/track title.
6. Media player plays song/track selected.

4.11. Use Case: Repeat song/track
1. User selects Repeat button during song/track playback (Figure 23).
2. Media player plays song/track again.
4.12. **Use Case: Search for song/track**
1. User selects ‘Search’ option from menu.
2. Media player returns input form.
3. User selects letter to search on.
4. Media player displays all song/title track matches.

4.13. **Use Case: Display song/track information**
1. User selects song/track to play.
2. Media player displays album/book cover image, album/book name, song/track number, song/track title, total time for track, community rating (Figure 24).

4.14. **Use Case: Rate song/track**
1. During playback, user presses Menu button.
2. Media player returns menu (Figure 25).
3. User selects ‘Rate track’ option.
4. Media player shows rating screen (Figure 26).
5. User selects ranking between 1-5 stars using left and right arrow buttons.
6. Media player stores ranking for song/track.