Mega MP3 Player

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Abstract

As technology races forward, and digital toys and gadgets flood the market, MP3 players are becoming more and more popular. One reason for this is the desire to store the most amount of music possible on a limited amount of disk space. MP3's are compressed music files that take up a 10th of the disk space that normal audio files consume. Although home systems can store infinite amounts of data it is complicated to have much more than 100Gb of storage for portable use. Since the technology does not exist ,to our knowledge, to reduce the size of music files the Mega MP3 Player will employ 80+Gb of disk space for automobiles giving the user more than enough space to store and play their music collections.

1. Introduction

1.1 Background Research

1.1.1 MP3File Format

For simplicity purposes MPEG Layer I/II format 3 (MP3) will be the only file format type that the Mega MP3 Player will support. The purpose of the Mega MP3 Player is to store as many songs as possible. MP3 file format provides the smallest audio file format on the market. Thus we have decided to only use MP3 file format for our player. As an addition to our MP3 player we will tack on a device number to each MP3 file so our player will be able to have a unique way of distinguishing all the files in the system.

1.1.2 MP3 Players

It should be realized here that there is no known marketable MP3 player like the Mega MP3 Player. The closest devices to it are portable high capacity MP3 players that have docking stations mounted in the automobile. However, none that we have found have more than 40Gb of storage.

1.2 Purpose/Design Goals

1.2.1 Store +80G Files

Imagine driving on a long road trip and not having to worry about constantly changing cds or listening to fuzzy local Podunk radio stations as you drive through small towns. The main purpose of the Mega MP3 Player is to issue the user with enough storage space that they will not have to worry about these irritations.

1.2.2 Size Target

The physical size of the Mega MP3 Player should be able to fit inside a standard car stereo casing unit. These dimensions are 6.5”X7.5”X2.5”. This goal should easily be obtainable as none of the components are even close to too large.

1.2.3 Sound

It is a goal to have quality sound come out of the Mega MP3 Player. We will consider the project a failure if the output sound is not pleasing.

1.3 Navigation

1.3.1 Taskbar

When the Mega MP3 Player is first powered on the user will see a taskbar with different options represented as symbols on the LCD. These options include: Navigate Hard Drive and Song Selector.

1.3.2 Navigate Hard Drive

In the Navigate Hard Drive mode the user will be able to sort through all the songs in the hard drive in order of device number. After the song the user desires is highlighted then they can either delete it or play it. After which the song following that will be played next and so on.

1.3.3 Song Selector

In the Song Selector mode the user will be able to punch in a number, which represents the device number. The player will go directly to that MP3 and start playing it and then play the next one after that and so on.

2. Project Tasks

2.1 Inputs

2.1.1 User Interaction/Control

User inputs are necessary in controlling our MP3 player. The inputs will consist of 14 pushbuttons and 1 knob. The knob will control the volume. There will be 0-9 numbers, play/select, skip/next, previous, and power pushbuttons.

2.1.2 USB

There will be a USB port on the face of the player. This is to make it necessary for the user to input data into the system. The capabilities will be client USB 1.1. This will require a host USB device to download the files onto the player e.g. laptop.

2.2 Outputs

2.2.1 Speaker

We obviously need some sort of output to get sound. The speaker output will come directly from the microcontroller.

2.2.2 LCD

The Mega MP3 Player will feature a Liquid Crystal Display (LCD), which will show the taskbar and the names and device numbers of the songs while in play mode.

2.3 Storage

2.3.1 Hard Drive

The Hard Drive will, as mentioned before, be able to hold 80+Gb of storage. We will use a laptop hard drive to achieve small space in terms of physical space. It will be set up with a database using the device numbers given to the files.

2.4 File Routing

2.4.1 Microcontroller

The Microcontroller will be able to handle incoming MP3 files, attach a device number to them and put them onto the hard drive. It will then be able to at the users commands grab files from the hard drive and either play them or delete them from the file system. It will be able to display file names and device numbers and taskbar symbols to the LCD. And lastly it will be able to output an analog sound of the correct MP3 file.

2.4.2 Converting/Moving Files

All of the digital to analog conversion will take place inside of the controller. The microcontroller is the hub of action for the player. In every phase of the process the controller will be involved.

3. Specific Task Interfaces

3.1 User Input

3.1.1 Volume Knob

The volume knob will just be a simple $2 knob that can be purchased at radio shack much like the picture below. [1]

Volume Knob

Knobs work much like potentiometers and ours will be a simple input to our controller that will control the volume.

3.1.2 Push Buttons

As mentioned before we will have 14 different pushbuttons for our player. Our controller has enough inputs to support all 14 buttons so it should be no problem running them directly into our controller.

3.2 Power

3.2.1 3V & 3.3V

We are going to need 3V and 3.3V for our controller. This will come from the car battery. We will purchase voltage converters that can be placed outside of the player.

3.2.2 *GND*

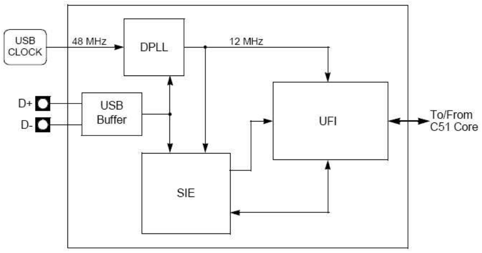
The ground can be connected to the common of the car and will just be a simple wire.

3.3 USB 1.1

3.3.1 Hardware

Our controller will be able to handle pretty much all of the USB controlling. All we need to do is buy a USB connector and just make sure the pins are connected right, like the D+ of the connector to the D+ of the microcontroller, etc.

3.3.2 USB Controller



USB Part of Controller

The controller part of the USB is part of our main controller. It handles all incoming and outgoing files and acts as a client to any host. [2]

3.4 LCD

3.4.1 Pixels

LCD

The LCD will employ 16X2 characters. Each character size is 3 X 5.23 mm. And each dot size is .56 X .61 mm. [3]

3.4.2 LCD Controller

Our main controller will drive the LCD controller. We will use a separate LCD controller that is controlled by the main controller. These controllers are a dime a dozen and we will the LR38840 made by sharp. [4]

3.5 Speakers

3.5.1 D/A Conversion

The digital to analog conversion takes place in the controller and we do not have to worry about anything. The controller has a built in MP3 decoder that will spit out the analog sound we need.

3.6 Hard Drive

3.6.1 File System

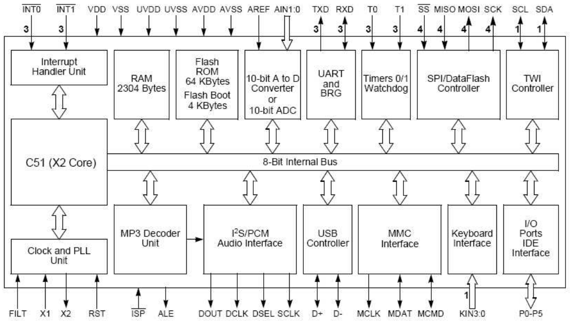
Hard Drive

- Capacity: 80.0 GB
- Interface: ATA/100
- RPM: 4200 RPM
- Height: 9.5 mm
- Screw Hole Pattern: New
- Avg Seek Time: 12 MS
- Buffer Speed: 8 MB

The above shows the capabilities and specs of our hard drive. It has a 40 pin output that we will multiplex into the IDE controller part of our controller.

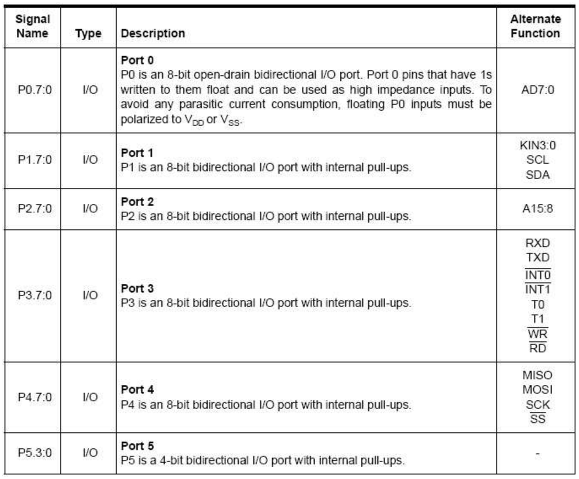
3.7 Microcontroller

3.7.1 Capabilities



Controller Layout

The chosen controller is the Atmel AT83C51SND1. [5] As you can see it provides a lot of capabilities needed for such a project. It was designed for MP3 players and is used in a variety of marketable devices. It provides us with an MP3 Decoder Unit, Audio interfacing capabilities, USB controller, IDE interfacing for the hard drive, keyboard interfacing for the pushbuttons, interrupt handler unit for user input, SPI controller for the LCD, RAM and flash ROM.



Signal Name	Type	Description	Alternate Function
P0.7:0	I/O	**Port 0** P0 is an 8-bit open-drain bidirectional I/O port. Port 0 pins that have 1s written to them float and can be used as high impedance inputs. To avoid any parasitic current consumption, floating P0 inputs must be polarized to V_{DD} or V_{SS}.	AD7:0
P1.7:0	I/O	**Port 1** P1 is an 8-bit bidirectional I/O port with internal pull-ups.	KIN3:0 SCL SDA
P2.7:0	I/O	**Port 2** P2 is an 8-bit bidirectional I/O port with internal pull-ups.	A15:8
P3.7:0	I/O	**Port 3** P3 is an 8-bit bidirectional I/O port with internal pull-ups.	RXD TXD $\overline{\text{INT0}}$ $\overline{\text{INT1}}$ T0 T1 $\overline{\text{WR}}$ $\overline{\text{RD}}$
P4.7:0	I/O	**Port 4** P4 is an 8-bit bidirectional I/O port with internal pull-ups.	MISO MOSI SCK $\overline{\text{SS}}$
P5.3:0	I/O	**Port 5** P5 is a 4-bit bidirectional I/O port with internal pull-ups.	-

Atmel AT83C51SND1 ports

The above table shows the ports and what they do for the Atmel AT83C51SND1.

4. Testing and Integration Strategy

4.1 Verification

4.1.1 All Parts

We will test the microcontroller with each of the individual parts. We will use the instruments in the lab to do so.

4.2 Correctness Testing

4.2.1 Output

The final testing will be done using a normal car amp and car speakers as the output. We will test by listening to the sound and see if it is satisfactory.

5. Group Communication Plans

5.1 Meetings

We will meet weekly on Wednesdays to discuss plans, troubles, issues, goals, deadlines, and give out assignments. Our weekly meetings will not start until the start of fall semester.

5.2 Internet

We also plan on communicating a lot through the Internet mostly by email. The Internet will be used mostly during the summer to communicate.

6. Schedule and Milestones

6.1 June

By the end of June we plan on contacting all of our vendors and purchasing our parts. This will not include resistors and capacitors and little parts like that.

6.2 July

July will be the month our parts are being shipped and will also be the month we will take care of any mishaps that happen during June, like if orders get messed up or companies run out of parts.

6.3 August

By the end of August we will have all the parts and we will have studied the language for programming our controller. We will have a schematic of the circuit and know which bits are going where.

6.4 September

By mid September we will have the power inputs and LCD output done. And by the end of September we will finish the pushbuttons and hard drive file format implemented.

6.5 October

By the end of October we will have finished the USB input the speaker output and have storing capabilities to the hard drive.

6.6 November

November will be our month to test and finish any of the issues we will encounter that carried over from October.

6.7 December

In December we will finish the report and show off our product.

7. Risk Assessment

7.1 Hard Drive Capabilities

One risk we could possibly encounter is not having enough controller oomph to control our hard drive. Such as not being able to read fast enough or not having enough ram to hold the software that controls our hard drive. If this is the case we will just implement the project using RAM instead of a hard drive and thus forfeit the purpose of having a huge amount of disk storage.

7.2 Space

Another risk we could encounter would be not fitting our entire MP3 player in the 6.5”x7.5”x2.5” space that a standard car stereo casing unit allows. If this is the case then we will just build it bigger than a car stereo casing unit and worry more about getting a working product.

8. Bill of Materials

Component	1st place of purchase	2nd place of purchase	Q	Cost
Toshiba HDD2188 MK-8025GAS	Drive solutions, Inc.	Bason Computer Inc.	1	$189.00-$210.00
LCD Screen FM162B	Global Sources	Drive Solutions	1	$11.00
Microcontroller-Atmel AT83C51SND1	Chipcatalog.com	Atmel.com	1	$200.00
Total Cost				$400.00-421.00

Bill of materials

We will be using the equipment in the EE labs in the MEB to test our parts. We will purchase all resistors, crystals, capacitors, and wires from there.

9. Vendor List

Drive Solutions

- www.drivesolutions.com

Bason Computer

- www.basoncomputers.com

Global Sources

- www.globalsources.com

Chip Catalog

- www.chipcatalog.com

Atmel

- www.atmel.com

All of our sources are online.

10.Conclusion

There are a few sketchy areas to this project at this point. Like exactness on how certain parts will integrate. We know that it is all possible but still need to iron out a few details. We will spend a lot of time this summer going over manuals and other information that will assist us in successfully completing this project.

11.References

[1] http://www.actionelectronic.com/cgi-bin/vcat/CatalogMgr.pl?cartID=b-3208&amp;SearchField=part&amp;SearchFor=cr-85-&amp;template=Htx/search.htx&amp;hdr=CA-%20POTS&amp;displayNumber=200

[2] http://www.atmel.com/dyn/resources/prod_documents/doc4109.pdf

[3] http://www.globalsources.com/gsol/GeneralManager?&catalog_id=2000000003844&design=clean&language=en&action=GetProduct&page=ProductDetail&product_id=8806006618&action=GetPoint&point_id=3000000149689

[4] http://sharp-world.com/products/device/lineup/ic/lcd-lsi/controller.html

[5] http://www.atmel.com/dyn/resources/prod_documents/doc4109.pdf