DQMusicBox - music player for people with dementia
How to build one – it's easy

17 September 2016

My Dad cannot operate normal music players. But he can operate this music player because it operates like a familiar two-know radio. My son & I were inspired to design this by the documentary Alive Inside which shows the profound joy felt by some people with dementia feel when listening to their favorite music.

It's easier than you think to make one. You can order the parts online. No soldering required. The hardest part is copying the software to the memory card.

Parts cost	~$170 + tax + shipping (most parts from Amazon), includes headphones.
Music cost	Minimal as you should use the recipient's existing music collection.
Build time	About three hours, once you have the parts & music.
Parts source	All parts can be mail ordered, links below.
Soldering?	No.
Command-line Linux?	No.
Tools needed	A computer with an SD card reader, fingers.
Laser cutter needed?	No. You can mail order the pre-cut pieces for the wood case.
Beverage?	Yes. I recommend a hoppy IPA while you are assembling.

1 Preview of the steps

1) Order parts from Amazon, eBay, Ponoko	2) Assemble recipient's favorite music	3) Copy software to micro-SD card
4) Receive parts from Ponoko	5) Glue case together	6) Screw in front panel items
7) Place Pi & plastic case	8) Connect wires	9) Power up & test

2 No warranty

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3 Acknowledgements

People were very generous with their time, and I really enjoyed the experience. This is certainly an incomplete list: Alex & Mike & others at Ada's, the super smart staff at Metrix, neighbor Randy, Stephen Christopher Phillips, Bob Rathbone, Stephen Rusk, Graham Hill, support at Ponoko, and my son.

4 Change log

v1.0, November 2015	Original release
V1.1, September 2016	• Changed music storage from a micro-SD memory card to a conventional USB memory stick. • Changed the base Operating System from full Raspbian (Wheezy) to DietPi (Jessie) – much smaller, so faster to boot, and less to go wrong.

5 What DQMusicBox does

5.1 For the person with dementia

Name	Description & implementation
Start song	Turning either of the knobs will start music playing.
Change song	Turn the songs knob.
Change volume	Turn the volume knob.
Pause	Tap the volume knob. Note that this also happens automatically – music pauses if there are no knob events in one hour.

5.2 For you

Name	Description & implementation
Shut down	Long hold (15-30 seconds) on the volume knob.
Reboot	Long hold (15-30 seconds) on the songs knob.
Add/remove music	By adding/removing files on the USB memory stick.
Troubleshoot	You can troubleshoot by connecting to a DQMusicBox over the network and reviewing the verbose logs.

6 Ordering the parts

6.1 Create a Ponoko account

Ponoko is a company that laser cuts wood and sends you the precisely cut pieces. You don't need to use Ponoko – you are welcome to take my case designs to your local maker space and cut there. In other words, Ponoko is convenient but not necessary. Ponoko works best if you live in or near NZ, US, UK, IT, DE. To create a Ponoko account:

1. Go to https://www.ponoko.com/
2. Choose "Get Making"

6.2 Order the parts

Link to order item	Notes	Alternative
DQMusicBox wood case (maple veneer)	From the linked page, choose "Add to Personal Factory".	Or do the laser cutting yourself using my existing free plans from github (/case/dqmusicbox_maple5.svg).
Raspberry Pi 3 Basic Starter Kit (the brains)	Includes a Pi 3, plastic case, power supply. Also includes a heat sink, but you don't need the heat sink.	
KY-040 rotary encoder knobs (2)	Order two of these.	
Pluggable USB audio adapter		
StarTech indictor LED		
Kingston 8GB micro-SD memory card		
Kingston USB 2.0 8GB stick		Or use your own USB memory stick, but it needs to be physically small as there isn't much space in the wood case.
Veewon male-female jumper wires		
TRIPP LITE 1ft headphone cable		
Panel mount headphone jack		
Sticky back velcro		Or use the sticky back Velcro that you already have.
Elmer's wood glue		Or use the wood glue you already have.
AmazonBasics Lightweight On-Ear Headphones		Or if the recipient already has familiar good headphones, use those instead.

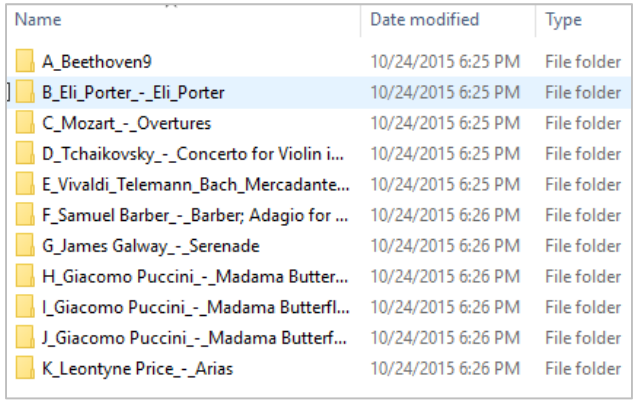
7 Assemble the personalized collection of music

7.1 Choosing the music - go for familiar favorites

This is the most important step. The personalized (familiar) music is the fundamental magic. You don't need much music, perhaps 6-10 albums. But only familiar favorites. One of the few benefits of dementia is that you don't remember what you just listened to and thus don't get tired of your favorite albums. In my case, my Mom mailed me my Dad's favorite CDs. It will take two weeks for the parts above to arrive, so you have time to do this well.

7.2 Put the music on the USB memory stick

Organize the digitized music into folders on the USB memory stick, one folder per album. MP3, iTunes, and FLAC files are supported i.e. files with extensions .mp3, .mp4, .aac, .flac. In the end, you should have a set of folders that looks something like this:



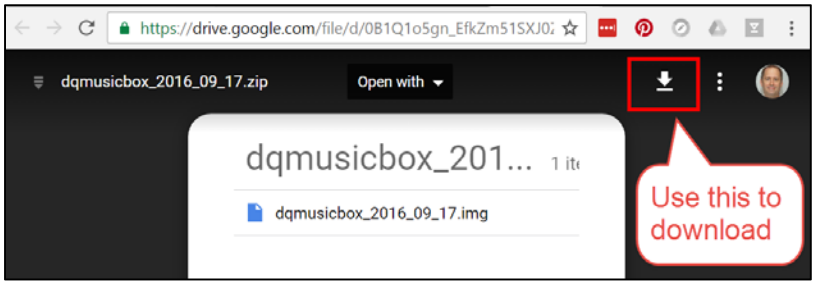
8 Prepare the micro-SD memory card

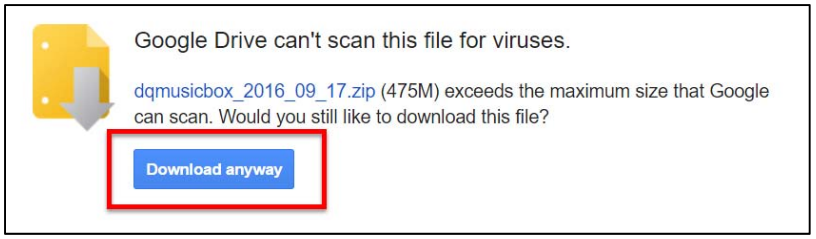
I prepared a disk image for you. Your job is to download this disk image and then write it to the micro-SD card. The instructions below assume that you are using a Windows computer with an SD card reader/writer. If you don't have a computer with an SD card reader/writer, you probably have a friend who does, and it only takes 10 minutes to write the image (after downloading). The steps:

1. If you are using Windows, install Win32 Disk Imager. This is what I use.

2. If you are using a Mac, try ApplePi-Baker. I haven't, but online articles recommend it. If a recent version (e.g. v1.9.4) doesn't work for you, try v1.5.1.

3. Download the DQMusicBox disk image. 475MB.



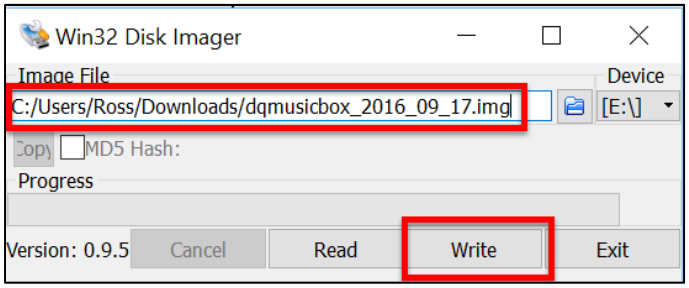


4. Unzip to extract dqmusicbox_2016_09_17.img.

5. Put the micro-SD memory card into the SD card adapter i.e. put the tiny card into the larger card.

6. Put the SD card adapter into the SD reader/writer in your computer.

7. Start the Win32 Disk Imager program, instruct it to write the image file to the SD card:



8. Wait for the writing to complete. This would be a good time to make a sandwich.

9 Put it all together

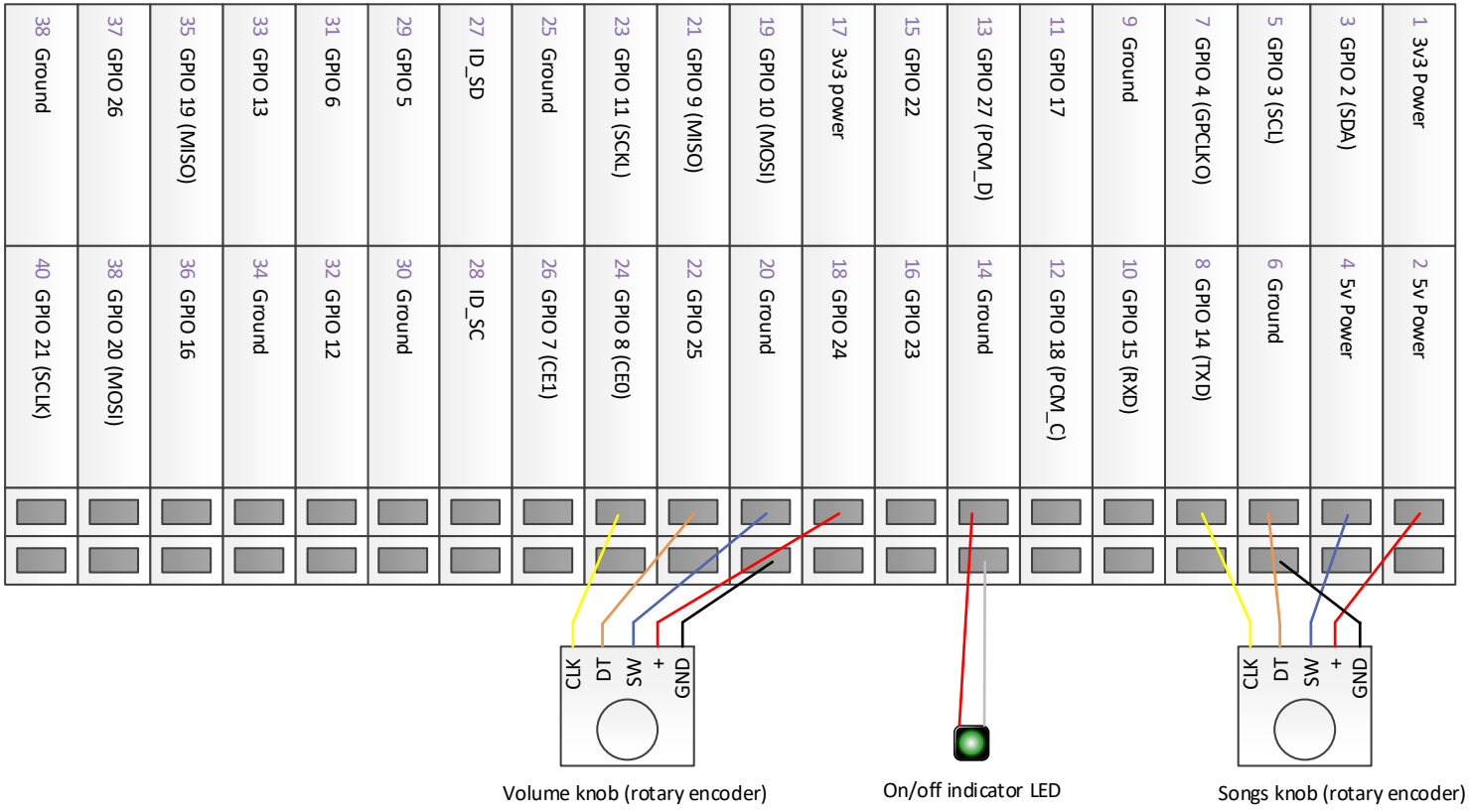
What you should end up with (with top removed):

I don't think you need all the steps listed out. But here are a few tips for putting it all together:

1. You don't need to stain or otherwise protect the case.
2. Glue the bottom and sides of the wood case. Put the top on, but don't glue it. Use painter's tape or other to hold the box together while the glue dries.
3. Put the Raspberry Pi into the plastic case.
4. Insert the USB items (audio adapter, memory stick) into USB ports on the Raspberry Pi.
5. Put the micro-SD memory card into the Raspberry Pi memory card slot.
6. Use Velcro to hold the plastic case (and its contents) in place in the wood case.
7. Mount the rotary encoders in the two medium-sized holes in front panel.
8. Find the indicator LED labeled HDD. Push this LED into the small hole in the front panel, it should fit snugly.
9. Mount the headphone jack connector in the large hole in the front panel.
10. Now add the wires:

You'll start from the unused pins on the Pi, which are arranged in two rows of twenty pins:

Use the wiring diagram to make the right connections. Just push the jumper cables in place – no soldering unless you really want to.



10 Test cases

Now that you have assembled everything, it is time to test.

Name	Description & Expectation
Light 15sec after power on	The indicator LED turns on when DQMusicBox is ready to play music, which is generally about 15 seconds after power on.
Start song	Turning either of the knobs will start music playing.
Change song	Turn the songs knob. If you go forward and backward through the song list as expected, then all is well.
Change volume	Turn the volume knob. If the volume goes up and down as expected, then all is well.
Pause	Tap the volume knob, song should pause. Tap the songs knob, this should also pause the song.
Shut down	Long hold (15-30 seconds) on the volume knob.
Reboot	Long hold (15-30 seconds) on the songs knob.

11 Congratulations

Congratulations! You should have a fully functional DQMusicBox.