How to Build the Dementia Friendly Music Player

Wood Model with Built-in Speakers (not Recommended for Headphone Use)

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I was inspired to design this by the documentary Alive Inside which shows the profound joy felt by some with dementia when listening to their favorite music.

My Dad could no longer operate the home stereo. But he could operate this music player because it operates like a familiar two-knob radio. The vintage style fit with his old intact memories – for most people with dementia, the old memories are the strong memories.

It's easier than you think to make one. Everything I did is open source. This document contains all the information you need. You can order the parts online, including the cut & engraved wood. It's a good family project – kids do well with this. It's also a project that friends would love to help you with.

Parts cost	~$200 + tax + shipping (~$95 if more make 10+ at a time, see Appendix 1)
Music cost	Minimal as you should use the recipient's existing music collection
Build time	Can be done in an afternoon, once you have the parts & music
Parts source	All parts can be mail ordered, links below
Soldering?	No
Woodworking?	No
Laser cutter needed?	No, you can mail order the pre-cut pieces for the wood case
With a friend?	Good idea, especially if your friend has the basic tools required
Beverage?	I recommend a hoppy IPA while you are assembling

No warranty

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Acknowledgements

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How it works

Tap to pause
Also pauses automatically after 1 hour of no knob activity
Turn to change volume
Turn to start music playing
VOLUME
SONGS
Turn to go to previous or next song
Music on USB drive

Preview of the steps

STEP 1: Order or make the case 	STEP 2: Order parts 	STEP 2: Assemble music
STEP 4: Flash the micro SD card 	STEP 5: Add the Pi 	STEP 6: Wire it
STEP 7: Test it 	STEP 8: Glue it 	STEP 9: Enjoy!

STEP 1: Find a friend to do this with

STEP 2: Decide about making vs. ordering the case

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 download my case design files from github and go to your local maker space and use the laser cutter there. Or buy yourself a laser cutter (if you do, will you be my friend?). In other words, Ponoko is convenient but not necessary. I have no affiliation with them, other than being a happy customer. Unless you are an experienced maker or woodworker, I recommend ordering the case – it will make the build process much easier.

STEP 3: Get the case file

1. Go to https://github.com/rosswesleyporter/dgmusicbox/tree/master/case/plus_model

2. Get the file you want:

3. Right-click on the desired file, choose “Save link as…”

STEP 4: Order the case

1. Go to https://www.ponoko.com/

2. Login (create an account if you haven't already)

3. Choose "Upload your design" and upload the file that you downloaded just above

4. Set the design colors as per below:

5. Choose "Confirm design size & colors"

6. Choose "Amber Bamboo Plywood"

7. Choose thickness = 6.7mm and then “Confirm material”

8. Make sure that everything looks as expected especially the check that the horizontal bar above SONGS is colored in

9. Click “Add to Cart”

STEP 5: Make the case (if you didn’t order it)

If you want to make the case rather than order the case:

1. Get the file that you want from https://github.com/rosswesleyporter/dqmusicbox/tree/master/case/plus_model
2. If you like, you can customize the case
3. Cut on your laser cutter or go to a makerspace and use a laser cutter there

If you are curious, this is what a design file looks like (showing the .lbrn Lightburn file):

STEP 6: Order the parts

If you plan to make 10+ units, see Appendix 1 rather than the table below.

Item	Supplier	Cost	Notes & alternatives
Case	Ponoko	$69.98	See instructions above
Raspberry Pi 4 Model B - 2GB RAM	AdaFruit	$35.00	Or buy Amazon B07TD42S27 (Pi 4). Or buy a Pi 3B+ and the appropriate power supply (not the Pi 4 power supply below).
Premium Female/Female Jumper Wires - 40 x 6"	AdaFruit	$3.95	Or buy Amazon B07GCY6CH7
Official Raspberry Pi 4 Power Supply 5.1V 3A with USB C	AdaFruit	$7.95	Or buy Amazon B07TYQRXTK
Panel Mount USB Cable - A Male to A Female	AdaFruit	$3.95	Or buy Amazon B0718XQPGB. Amazon B07C87FYLY *may* work, but you'll also need to buy M3 screws.
M2.5 standoffs (spacing screws)	Amazon	$10.99	Or buy Amazon B075K3QBMX
M2.5 screws 12mm M2.5-0.45	Amazon	$6.48	You can probably also buy these at a good hardware store for less
Speaker cloth (brown, large piece)	Amazon	$9.99	Or buy Amazon B01HMBKNSS (black, large cloth)
Speakers	Amazon	$9.99	Or buy Amazon B01KC7WGQQ
16GB micro SD card	Amazon	$4.95	Or buy Amazon B06XWN9Q99 or other 16GB+ card
USB thumb drive	Amazon	$6.34	Or Amazon B07MDXBT87 or other physically small USB drive
KY-016 indicator LED	Amazon	$17.99	This is for a large kit of sensors, you only need KY-016. Or search KY-016, but note that almost all other sellers are in China.
KY-040 rotary encoders (knobs)	Amazon	$7.99	Or buy Amazon B06XQTHDRR
Sticky back velcro strips	Amazon	$4.91	Or buy Amazon B0035GZCHC
TOTAL		**$200.46**	+ tax + shipping

STEP 7: Get wood finish product (optional)

STEP 8: Gather tools & supplies

STEP 19: Get a computer with an SD card slot

STEP 10: Apply a wood finish (optional)

If you choose to use spray lacquer, see this short video from Woodworking for Mere Mortals. The method shown is much faster than the instructions on the spray bottle. It takes about 15 minutes of work spread across two hours.

STEP 11: Cut & glue speaker fabric

STEP 12: Cut & tape paper to inside of LED hole

STEP 13: Assemble the personalized collection of music

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. 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. Though it is easy to change the set of music later.

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, .m4a, .flac. In the end, you should have a set of folders that looks something like this:

Name	Date modified	Type
A_Beethoven9	10/24/2015 6:25 PM	File folder
B_Eli_Porter_-_Eli_Porter	10/24/2015 6:25 PM	File folder
C_Mozart_-_Overtures	10/24/2015 6:25 PM	File folder
D_Tchaikovsky_-_Concerto for Violin i...	10/24/2015 6:25 PM	File folder
E_Vivaldi_Telemann_Bach_Mercadante...	10/24/2015 6:25 PM	File folder
F_Samuel Barber_-_Barber; Adagio for ...	10/24/2015 6:26 PM	File folder
G_James Galway_-_Serenade	10/24/2015 6:26 PM	File folder
H_Giacomo Puccini_-_Madama Butter...	10/24/2015 6:26 PM	File folder
I_Giacomo Puccini_-_Madama Butterfl...	10/24/2015 6:26 PM	File folder
J_Giacomo Puccini_-_Madama Butterf...	10/24/2015 6:26 PM	File folder
K_Leontyne Price_-_Arias	10/24/2015 6:26 PM	File folder

STEP 14: Copy software to the micro-SD memory card

I prepared a disk image for you. It has all the required software. Your job is to download this disk image and then write it to the micro-SD card. The steps:

1. Install Balena Etcher on your PC or Mac or Linux computer. Win32 Disk Imager also works.

2. Download the Dementia Friendly Music Player disk image.

3. Confirm download – "Download anyway"

4. Put the micro-SD memory card & adapter into the SD reader/writer in your computer.

5. Start Balena Etcher, instruct it to write the image file to the SD card:

6. Wait for the writing to complete, ~10 minutes. This would be a good time to make a sandwich.

STEP 15: Insert the clasp piece

STEP 16: Insert the LED stand

STEP 17: Velcro speakers to the shelf

STEP 18: Attach the USB panel

STEP 19: Insert USB drive

STEP 20: Insert micro SD card

STEP 21: Mount the Pi

STEP 22: Test it

STEP 23: Wire it

STEP 24: Add LED

STEP 25: Mount rotary encoders

STEP 26: Wire up components

STEP 27: Verify wiring

STEP 28: Test it again

STEP 29: Adjust the knob wiring (if necessary)

STEP 30: Bundle speaker wires, add standoffs

STEP 31: Add the shelf

STEP 32: Attach at the clasp (screws)

STEP 33: Tape to wall (makes next steps easier)

STEP 34: Add glue

STEP 35: Verify glue

STEP 36: Put the pieces together

STEP 37: Clamp it lightly – painter’s tape

STEP 38: Clamp it tightly – duct tape

STEP 39: Glue the knobs

STEP 40: Let the glue dry

STEP 41: Remove the tape

STEP 42: Adjust the knobs (if necessary)

STEP 43: Tape instructions

Print this page and tape the instructions in the box below to the bottom of your new Dementia Friendly Music Player:

To create personalized music

Organize the music on your computer

One folder per album. Use MP3 files, must have .mp3 file extension. Or iTunes files (.m4a). Or FLAC files (.flac). Optionally, use folder names prefixes to specify the play order e.g. A_, B_

Copy the music to the USB thumb drive

1. Unplug the Dementia Friendly Music Player.
2. Remove the USB thumb drive and place in your computer.
3. Copy music files from your computer to the USB thumb drive.
4. Put the USB thumb drive back in.
5. Plug in your Dementia Friendly Music Player.

STEP 44: Done!

Congratulations! You should have a fully functional Dementia Friendly Music Player.

Appendix 1: Building 10+ at a time

Assumptions:

- You want to build 10 or more units at a time
- You are planning this far enough in advance (6 weeks or more) that you can order some of the parts directly from China
- Two ways to make the case – laser cut it yourself or order with a quantity discount from Ponoko
- If you order in quantity 10+ from Ponoko, you get a ~40% discount
- If you are planning to laser cut the case yourself, or in conjunction with a maker space, I suggest using 5.2mm cherry MDF wood
    - Looks great, is commonly available, laser cuts well
    - Ideally apply some wood finish (see above)
    - At my supplier, a 4'x8' sheet is $55, and you can make as many as 12 cases from it
    - For the cost estimate below, I'm assuming 15 minutes of laser time at $1 per minute
    - For laser cutting, be sure to use the matching 5.2mm file from github
    - You'll need the rubber feet (see below) as the 6mm shaft of the standoffs will protrude slightly from the bottom of the case

# units to make	10					
Item	**Supplier**	**Quan**	**Each**	**Total**	**Per unit**	**Notes**
Wood case	Maker space	10	$21.50	$215.00	$21.50	Or order 10+ from Ponoko for @$46.53
Raspberry Pi 4 Model B - 2GB RAM	AdaFruit	10	$35.00	$350.00	$35.00	
Official Raspberry Pi Power Supply 5.1V 3A with USB C - 1.5 meter long	AdaFruit	10	$7.95	$79.50	$7.95	
Panel Mount USB Cable - A Male to A Female	AdaFruit	10	$3.95	$39.50	$3.95	
Female-female jumper wires 30cm	Ali Express	10	$1.24	$12.40	$1.24	
M2.5x6mm + 6mm standoffs (50 pieces)	Ali Express	1	$2.43	$2.43	$0.24	
M2.5x15mm + 6mm standoffs (50 pieces)	Ali Express	1	$3.49	$3.49	$0.35	
M2.5x20mm + 6mm standoffs (50 pieces)	Ali Express	1	$4.04	$4.04	$0.40	
M2.5 screws 12mm M2.5-0.45 (100 pieces)	Amazon	1	$6.48	$6.48	$0.65	
Speaker cloth (large cloth)	Amazon	1	$9.99	$9.99	$1.00	
Speakers	Amazon	10	$9.99	$99.90	$9.99	
Micro SD card	Amazon	10	$4.95	$49.50	$4.95	
USB flash drive	Amazon	10	$6.34	$63.40	$6.34	
KY-040 rotary encoders (knobs)	Ali Express	20	$0.72	$14.40	$1.44	
KY-016 indicator LED (10 pieces)	Ali Express	1	$1.92	$1.92	$0.19	
Sticky back velcro strips (5 yards)	Amazon	1	$7.98	$7.98	$0.80	
Sticky back rubber feet (100 pieces)	Ali Express	1	$1.17	$1.17	$0.12	Only needed for wood < 6mm thick
TOTAL					**$96.11**	+ tax + shipping

Appendix 2: Change log

v1, November 2015	Original release for this speaker centric model
v2, 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 to DietPi – much smaller, so faster to boot, and less to go wrong.
v3, January 2017	• Changed from USB audio to Pi built-in audio, including a firmware update for excellent audio quality.
v4, May 2017	• Switched to bamboo for durability and use of standoffs. • Switched to Pi A+ to lower cost. • Made USB thumb drive externally accessible, to make it easier for the caregiver to organize music.
v4.01, 25 June 2017	• Minor edits.
v4.01_1, 20 July 2017	• Minor edits.
v4.01_2, 11 August 2017	• Added links for ordering parts in the UK. • Added detailed instructions for write protecting a micro-SD card.
v4.01_3, 12 August 2017	• Minor edits
v4.01_4, 12 August 2017	• Minor edits
v4.01_5, 14 October 2017	• Edited text and updated photographs to reflect the change from an HDD-style LED to a KY-016 LED module.
v4.01_6, 26 February 2018	• Updated the links for purchasing the parts. No changes to the parts themselves, just the links. • Minor change to the instructions, noting how the build can be accomplished in one sitting, if desired.
v4.1, 7 April 2018	• Reflects that the software has been updated to support the new Raspberry Pi 3 B+. No new software features.
v4.1_1, 23 April 2018	• Updated to reflect the new bamboo case design.
v4.1_2, 22 July 2018	• Updated for the new cherry wood version
27 Jan 2019	• Updated to note support for the Raspberry Pi 3A+.
v4.2, 1 March 2019	• Switched to pmount for USB drive auto mounting.
v4.2, 7 April 2018	• Removed instructions for write protecting the SD card – rarely used and may cause certain rare problems
v4.2, 26 October 2019	• Updated the parts list • Updated Ponoko instructions
v4.2, 28 October 2019	• Updated Ponoko instructions
v4.2.1, 30 October 2019	• Changed link to the new v4.2.1 of the software image • Noted support for Pi 4 • Updated Ponoko instructions to match Ponoko's updated user interface
v4.2.1, 19 December 2019	• Minor update – naming conventions
v4.2.1, 22 December 2019	• Updated to reflect the change from cherry to bamboo e.g. updated almost all of the photos. • Added new steps to the instructions, particularly mid-point tests and troubleshooting.
v4.2.1, 15 March 2020	• Updated to reflect the new speaker centric model
v4.2.1, 15 March 2020	• Edited for clarity
v4.2.1, 13 April 2020	• Edited for clarity
v4.2.1, 19 September 2020	• Updated parts list, updated github folder names to better match product names
v4.2.1, 20 September 2020	• Updated parts list, updated github folder names to better match product names