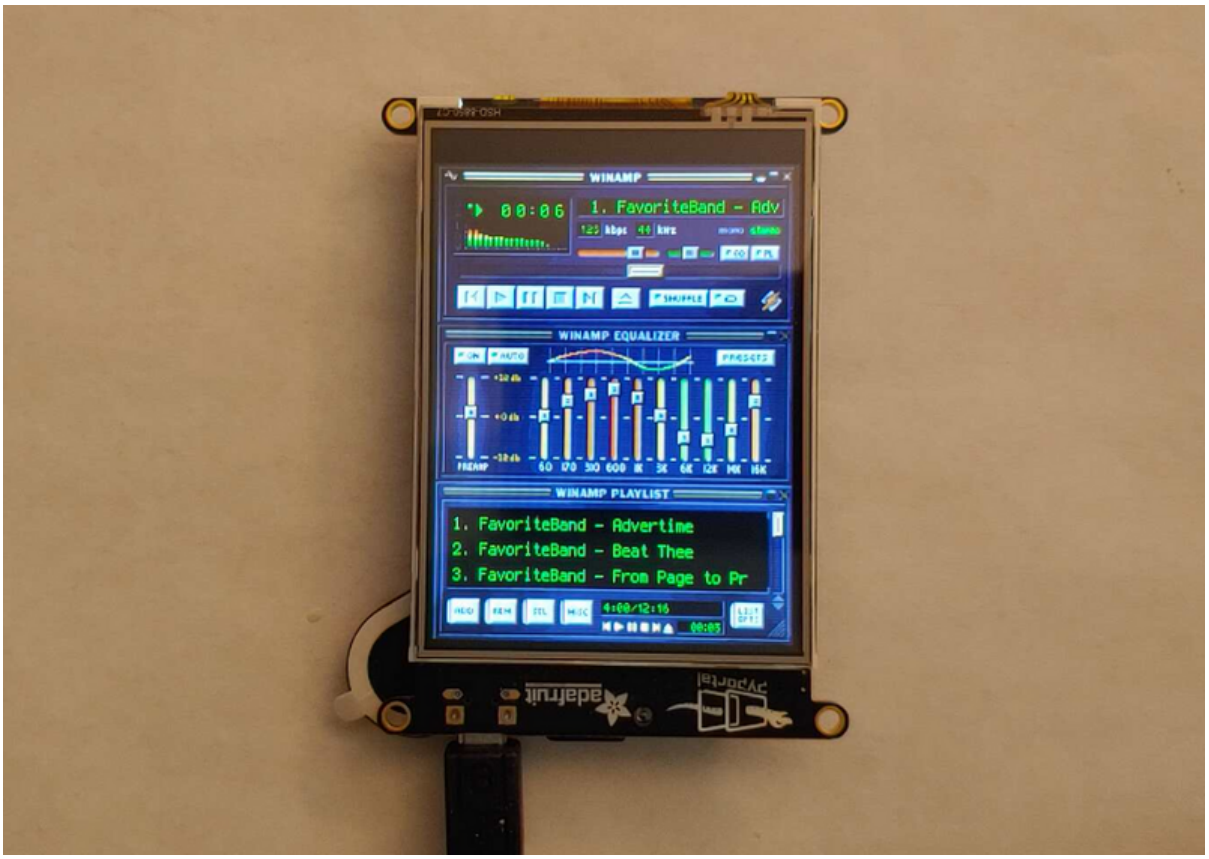
PyPortal Winamp MP3 Player

Created by Tim C



https://learn.adafruit.com/pyportal-winamp-mp3-player

Last updated on 2025-03-17 05:29:24 PM EDT

Table of Contents

Overview

Bring back the good ol' days of Llama whippin' fun.

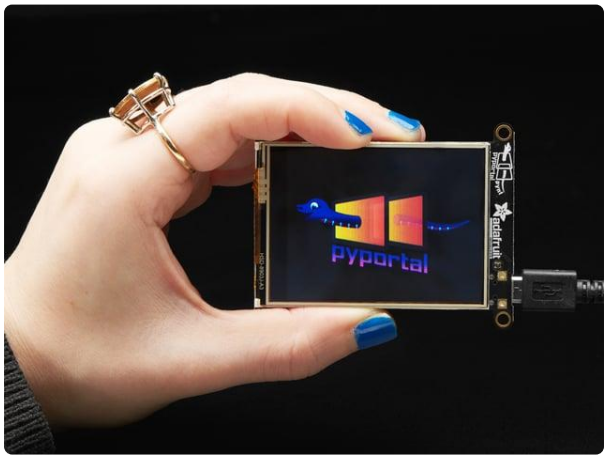
This project will turn your PyPortal into an MP3 player to play your favorite tunes with the familiar Winamp look. Create and manage multiple JSON playlists and rock out to whichever one fits the mood.

Take it a step further by choosing a custom Winamp skin (https://adafru.it/YBo) and convert it for use on your PyPortal.

To keep this project simple, and since CircuitPython doesn't have an advanced equalizer, instant scanning, left/right pan or fast-forwarding/ rewinding capability a lot of the user interface doesn't have input support - you can play/pause, forward track and back track.

Parts

Adafruit PyPortal - CircuitPython Powered Internet Display
PyPortal, our easy-to-use IoT device that allows you to create all the things for the “Internet of Things” in minutes. Make custom touch screen interface...
https://www.adafruit.com/product/4116

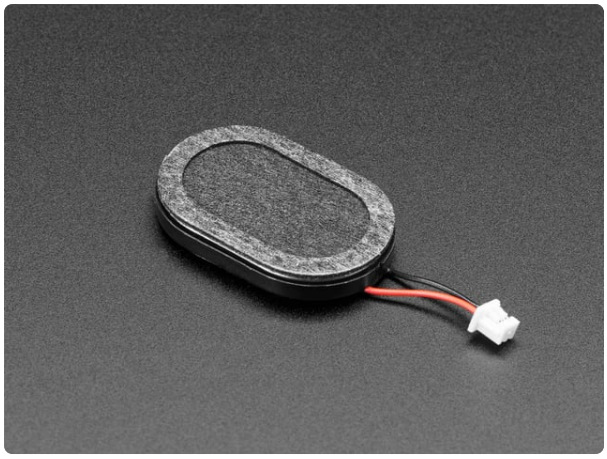


Adafruit PyPortal Pynt - CircuitPython Powered Internet Display
The PyPortal Pynt is the little sister to our popular PyPortal - zapped with a shrink ray to take the design...
https://www.adafruit.com/product/4465

Adafruit PyPortal Titano

The PyPortal Titano is the big sister to our popular PyPortal now with twice as many pixels! The PyPortal...

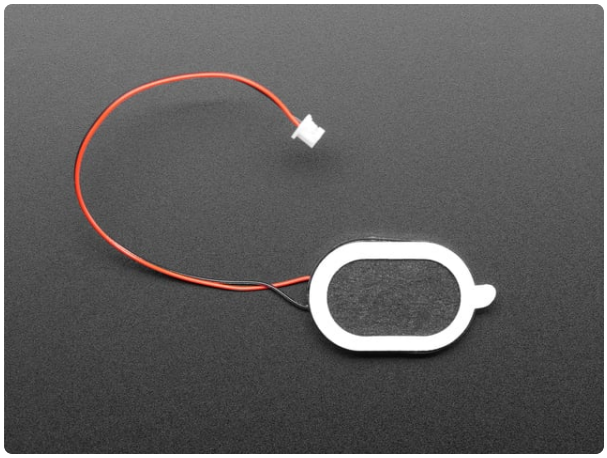
https://www.adafruit.com/product/4444



Mini Oval Speaker with Short Wires - 8 Ohm 1 Watt

Hear the good news! This wee speaker is a great addition to any audio project where you need 8 ohm impedance and 1W or less of power. We particularly like...

https://www.adafruit.com/product/4227

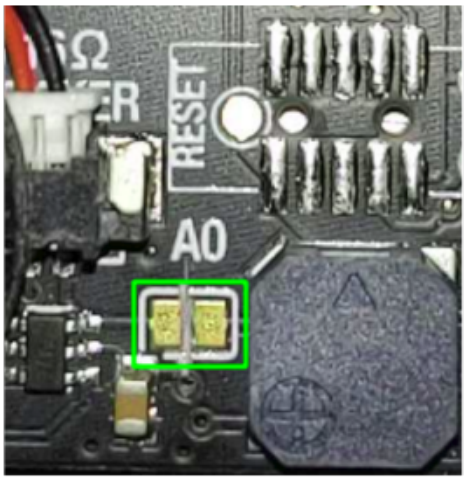


Mini Oval Speaker - 8 Ohm 1 Watt

Hear the good news! This wee speaker is a great addition to any audio project where you need 8 ohm impedance and 1W or less of power. We particularly like...

https://www.adafruit.com/product/3923

External Speaker



The PyPortal does have a built-in speaker but it's fairly small. If you want your tunes to play louder you may use a larger speaker.

Luckily the PyPortal contains a plug-in adapter for just that!

If you do want to use the external speaker, you must cut a small jumper connection on the board in order to prevent the built-in speaker from playing in addition to the external one.

Prepare Playlists

Convert MP3s

CircuitPython works best with **stereo** or **mono** MP3 files from **32kbit/s** to **128kbit/s**, with sample rates from **16kHz** to **44.1kHz**. If your files are different, you can convert them using the free software Audacity (https://adafru.it/Bof). See MP3 Export Options (https://adafru.it/Lee) in the Audacity docs for more details.

Copy Music to micro SDCard

Circuitpython supports FAT and FAT32 filesystems. If your micro SDCard is not already formatted with one of those filesystems, then use a PC to format it.

Once formatted, connect it to your PC and copy your MP3 song files onto it. You can sort them into different directories if you want, using any organization that you want. Or you can put them all in the root of the micro SDCard. Just make sure the paths in the **playlist.json** file match the paths to the files on your micro SDcard.

If you want the artist's name to be shown, then you'll need to include it in the filename. For example:

FavoriteBand - Amazing Song of Awesome.mp3

Prepare Playlist JSON

The PyPortal Winamp player reads the playlist from the file **playlist.json** stored on your **CIRCUITPY** drive. If you'd like, you can create extra **playlist_[something].json** files on your drive and switch between them by renaming the one you want to use to **playlist.json**. This allows you to set up as many playlists as you want so you have appropriate jams for any occasion.

A sample **playlist.json** file is shown below. You can use it as a starting point. Modify the file names and paths to match your songs you copied onto the microSD card in the previous step.

```
{
  "playlist": {
    "files": [
      "/sd/FavoriteBand - Advertime.mp3",
      "/sd/FavoriteBand - Beat Thee.mp3",
      "/sd/FavoriteBand - From Page to Practice.mp3",
      "/sd/FavoriteBand - Study and Relax.mp3",
      "/sd/FavoriteBand - The Celebrated Minuet.mp3"
    ]
  }
}
```

Once you've got your song files listed, save a copy as **playlist.json** on your **CIRCUITPY** drive. You can have additional **playlist_[something].json** files if you'd like, but you must have exactly one named **playlist.json** if your using the default configuration inside of **code.py**.

Project Setup

As of CircuitPython 9, a mount point (folder) named /sd is required on the CIRCUITPY drive. Make sure to create that directory after upgrading CircuitPython.

Follow these steps to create the /sd directory

https://adafru.it/19ei

Are you new to using CircuitPython? No worries, [there is a full getting started guide here (https://adafru.it/cpy-welcome)](https://adafru.it/cpy-welcome).

Plug the PyPortal into your computer with a known good USB cable (not a tint charge only cable). The PyPortal will appear to your computer as a flash drive named **CIRCUITPY**. If the drive does not appear you can [install CircuitPython (https://adafru.it/EnM)](https://adafru.it/EnM) on your PyPortal and then return here.

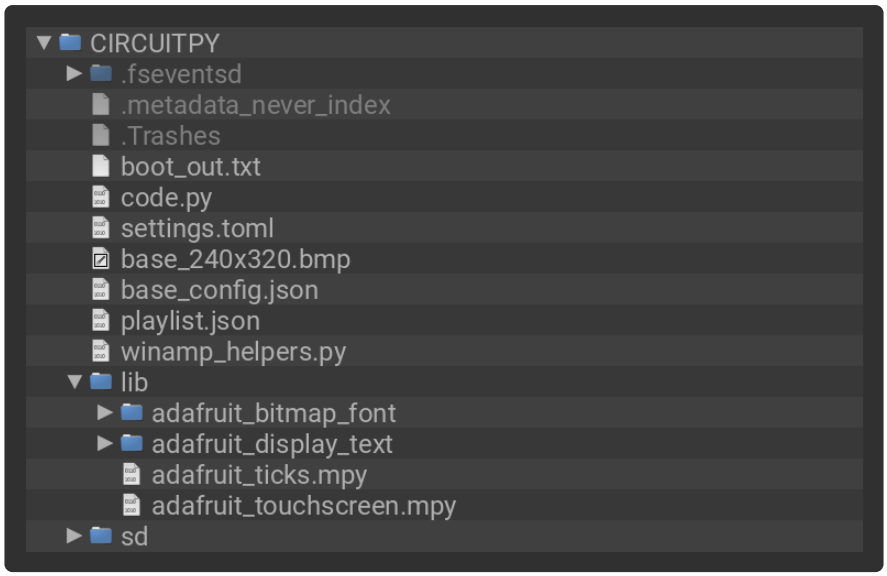
Download the project files with the Download Project Bundle button in the Code section. Unzip the file and copy/paste the **code.py** and other project files to your **CIRCUITPY** drive using File Explorer or Finder (depending on your operating system).

Inside the project bundle you'll find all of the files you need on your PyPortal. There is also a **PyPortal_Winamp_Skin_Converter** directory which does not need to go onto your PyPortal. It's used from your PC if you want to use a [custom skin for your Winamp Player (https://adafru.it/YBq)](https://adafru.it/YBq).

Drive Structure

After copying the files, your drive should look like the listing below. It can contain other files as well, but must contain these at a minimum:

Remember to to remove the PyPortal_Winamp_Skin_Converter directory, it does not need to go onto the CIRCUITPY drive.



Code

The project **code.py** is shown below. The next page [walks through how the code works. (https://adafru.it/YBr)](https://adafru.it/YBr)

```
# SPDX-FileCopyrightText: 2022 Tim C, written for Adafruit Industries
#
# SPDX-License-Identifier: Unlicense
"""
PyPortal winamp player
"""
import time
import sys
import storage
import board
import busio
import adafruit_touchscreen
import sdcardio
from winamp_helpers import WinampApplication

# which playlist to play
PLAYLIST_FILE = "playlist.json"

# which skin background to use
SKIN_IMAGE = "/base_240x320.bmp"

# skin configuration for color values
SKIN_CONFIG_FILE = "base_config.json"

# must wait at least this long between touch events
TOUCH_COOLDOWN = 0.5  # seconds

# display orientation. Must be 90 or 270.
ORIENTATION = 90

PYPORTAL_TITANO = False

if not PYPORTAL_TITANO:
    SIZE = (240, 320)
    if ORIENTATION == 270:
        # setup touch screen
        ts = adafruit_touchscreen.Touchscreen(
            board.TOUCH_YD,
            board.TOUCH_YU,
            board.TOUCH_XR,
```

```
            board.TOUCH_XL,
            calibration=((5200, 59000), (5800, 57000)),
            size=(240, 320),
        )
    elif ORIENTATION == 90:
        # setup touch screen
        ts = adafruit_touchscreen.Touchscreen(
            board.TOUCH_YU,
            board.TOUCH_YD,
            board.TOUCH_XL,
            board.TOUCH_XR,
            calibration=((5200, 59000), (5800, 57000)),
            size=(240, 320),
        )
    else:
        raise ValueError("ORIENTATION must be 90 or 270")
else:  # PyPortal Titano
    SIZE = (320, 480)
    if ORIENTATION == 270:
        # setup touch screen
        ts = adafruit_touchscreen.Touchscreen(
            board.TOUCH_YD,
            board.TOUCH_YU,
            board.TOUCH_XR,
            board.TOUCH_XL,
            calibration=((5200, 59000), (5800, 57000)),
            size=(320, 480),
        )
    elif ORIENTATION == 90:
        # setup touch screen
        ts = adafruit_touchscreen.Touchscreen(
            board.TOUCH_YU,
            board.TOUCH_YD,
            board.TOUCH_XL,
            board.TOUCH_XR,
            calibration=((5200, 59000), (5800, 57000)),
            size=(320, 480),
        )

# Initializations for SDCard
spi = busio.SPI(board.SCK, board.MOSI, board.MISO)
sdcard = sdcardio.SDCard(spi, board.SD_CS)
vfs = storage.VfsFat(sdcard)
storage.mount(vfs, "/sd")
sys.path.append("/sd")

# debugging, print files that exist on SDCard
# print(os.listdir("/sd"))

# get reference to the display
display = board.DISPLAY

# set rotation
display.rotation = ORIENTATION

# Initialize WinampApplication helper class
winamp_application = WinampApplication(
    playlist_file=PLAYLIST_FILE,
    skin_image=SKIN_IMAGE,
    skin_config_file=SKIN_CONFIG_FILE,
    pyportal_titano=PYPORTAL_TITANO,
)

# Add the Group to the Display
display.root_group = winamp_application

# previous iteration touch events
_previous_touch = None
```

```
# last time a touch occured
_previous_touch_time = 0

# main loop
while True:
    # update winamp application
    winamp_application.update()

    # check for touch events
    p = ts.touch_point
    _now = time.monotonic()
    # if touch cooldown time has elapsed
    if _now >= _previous_touch_time + TOUCH_COOLDOWN:
        # if there is a touch
        if p and not _previous_touch:
            # store the time to compare with next iteration
            _previous_touch_time = _now
            # if touch is on bottom half
            if p[1] > SIZE[1] // 2:
                # if touch is on right half
                if p[0] >= SIZE[0] // 2:
                    winamp_application.next_track()

                # if touch is on left half
                else:
                    winamp_application.previous_track()
            # if touch is on top half
            else:
                # if currently playing song
                if winamp_application.CURRENT_STATE ==
winamp_application.STATE_PLAYING:
                    print("pausing")
                    winamp_application.pause()

                # if song is paused
                else:
                    print("resuming")
                    winamp_application.resume()

    # store previous touch event t compare with next iteration
    _previous_touch = p
```

Code Walk-Through

Architecture

The project is split into two python code files. **code.py** and **winamp_helpers.py**. We know that **code.py** is the file that CircuitPython will execute automatically for us. It contains the initialization for the display, touch overlay, and SDCard. It also creates the `WinampApplication` object and reads the input data from the touch overlay to decide what actions should be taken and when.

code.py

There are a handful of configuration variables that can be used to control different aspects of the player.

- `PLAYLIST_FILE` - The name of the playlist file that should be played. You can leave the default **playlist.json** or change it to your own custom playlist file. I like to create multiple playlist files with descriptive names and then rename the one I am in the mood for to **playlist.json** rather than changing the variable.
- `SKIN_IMAGE` - The name of the BMP image file for the skin that you want to use. The default is **base_240x320.bmp**, see the next page (https://adafru.it/YBq) for instructions on using custom skins.
- `SKIN_CONFIG_FILE` - The name of the JSON configuration file for the chosen skin. Default is **base_config.json**.
- `TOUCH_COOLDOWN` - Time in seconds to wait before allowing another touch event to be registered. Leave it as the default `0.5` seconds, or lower it if you'd like the app to be able to respond more rapidly to multiple touch events.
- `ORIENTATION` - The rotation value for the display. Must be either `90` or `270` which are the two possible portrait orientations. Default is `90`.

The following occur in **code.py** as setup for various things:

Initializing the touch input based on the `ORIENTATION` setting:

```
if ORIENTATION == 270:
    # setup touch screen
    ts = adafruit_touchscreen.Touchscreen(
        board.TOUCH_YD,
        board.TOUCH_YU,
        board.TOUCH_XR,
        board.TOUCH_XL,
        calibration=((5200, 59000), (5800, 57000)),
        size=(240, 320),
    )
elif ORIENTATION == 90:
    # setup touch screen
    ts = adafruit_touchscreen.Touchscreen(
        board.TOUCH_YU,
        board.TOUCH_YD,
        board.TOUCH_XL,
        board.TOUCH_XR,
        calibration=((5200, 59000), (5800, 57000)),
        size=(240, 320),
    )
```

Initialize the SDCard so that we can read the song MP3 files from it:

```
spi = busio.SPI(board.SCK, board.MOSI, board.MISO)
sdcard = sdcardio.SDCard(spi, board.SD_CS)
vfs = storage.VfsFat(sdcard)
```

```
storage.mount(vfs, "/sd")
sys.path.append("/sd")
```

Access the built-in display, and set it's orientation based on our `ORIENTATION` setting.

```
# get reference to the display
display = board.DISPLAY

# set rotation
display.rotation = ORIENTATION
```

Create a `WinampApplication` object and set it as the root_group on the display:

```
# Initialize WinampApplication helper class
winamp_application = WinampApplication(
    playlist_file=PLAYLIST_FILE,
    skin_image=SKIN_IMAGE,
    skin_config_file=SKIN_CONFIG_FILE,
)

# Add the Group to the Display
display.root_group = winamp_application
```

Main loop

Inside the main loop there are two main tasks that occur:

- Call `winamp_application.update()` to refresh the UI. This will update the clock display, allow the track title bar to scroll, and update the playlist display based on the current track number. It will open and begin playing the next song when the current one has finished playing.
- Check for touch events coming from the touch overlay and call the appropriate action functions on the `winamp_application` object when touches are detected.

The Winamp skin is decoration only, the controls within it are too tiny for us to use on the PyPortal without a very precise stylus and perfectly calibrated touch overlay.

There are 3 invisible buttons that are used to control the application. The entire top half of the screen is the pause/resume button. The bottom half of the screen is split vertically, the left half is the previous track button, and the right half is the next track button.

Helper Classes

There are three helper classes inside of **winamp_helpers.py** that are used in the project. All of these classes extend `displayio.Group` so they can be added to other groups and shown on the display.

- `WinampApplication` - This is a high level object that manages the player. It initializes the skin graphics, and other displayio widgets used in the UI. It has action functions which get called from the main loop when touch events occur: `pause()`, `resume()`, `next_track()`, and `previous_track()`. The `update()` function must be called once per iteration in the main loop to process all visual updates in the UI and advance to the next track when needed. The `play_current_track()` function is responsible for opening and playing MP3 files.

- `ClockDisplay` - This is a displayio widget that contains the labels needed to show the elapsed time during playback near the top left of the UI. Time showing is updated via the `seconds` property. This custom widget was created because the spacing used for the clock digits in some of the Winamp skins is very specific. A standard Label with the default font would not match the spacing correctly.

- `PlaylistDisplay` - Another displayio widget, this one contains the labels used to show the current track and next two track titles in the bottom part of the UI. It also manages which track is considered the current track for us, which is updated via the `current_track_number` property. `current_track_title` is a convenience property that will format the current track name into a suitable string to be shown in the `ScrollingLabel` near the top right of the UI.

Further Detail

The source code is thoroughly commented to explain what the statements are doing. You can read through the code and comments to gain a deeper understanding of how it functions, or modify parts of it to suit your needs.

code.py:

```
# SPDX-FileCopyrightText: 2022 Tim C, written for Adafruit Industries
#
# SPDX-License-Identifier: Unlicense
"""
PyPortal winamp player
"""
import time
import sys
import storage
import board
import busio
import adafruit_touchscreen
import sdcardio
from winamp_helpers import WinampApplication

# which playlist to play
PLAYLIST_FILE = "playlist.json"

# which skin background to use
SKIN_IMAGE = "/base_240x320.bmp"

# skin configuration for color values
SKIN_CONFIG_FILE = "base_config.json"

# must wait at least this long between touch events
TOUCH_COOLDOWN = 0.5  # seconds

# display orientation. Must be 90 or 270.
ORIENTATION = 90

PYPORTAL_TITANO = False

if not PYPORTAL_TITANO:
    SIZE = (240, 320)
    if ORIENTATION == 270:
        # setup touch screen
        ts = adafruit_touchscreen.Touchscreen(
            board.TOUCH_YD,
            board.TOUCH_YU,
            board.TOUCH_XR,
            board.TOUCH_XL,
            calibration=((5200, 59000), (5800, 57000)),
            size=(240, 320),
        )
    elif ORIENTATION == 90:
        # setup touch screen
        ts = adafruit_touchscreen.Touchscreen(
            board.TOUCH_YU,
            board.TOUCH_YD,
            board.TOUCH_XL,
            board.TOUCH_XR,
            calibration=((5200, 59000), (5800, 57000)),
            size=(240, 320),
        )
    else:
        raise ValueError("ORIENTATION must be 90 or 270")
else:  # PyPortal Titano
```

```
    SIZE = (320, 480)
    if ORIENTATION == 270:
        # setup touch screen
        ts = adafruit_touchscreen.Touchscreen(
            board.TOUCH_YD,
            board.TOUCH_YU,
            board.TOUCH_XR,
            board.TOUCH_XL,
            calibration=((5200, 59000), (5800, 57000)),
            size=(320, 480),
        )
    elif ORIENTATION == 90:
        # setup touch screen
        ts = adafruit_touchscreen.Touchscreen(
            board.TOUCH_YU,
            board.TOUCH_YD,
            board.TOUCH_XL,
            board.TOUCH_XR,
            calibration=((5200, 59000), (5800, 57000)),
            size=(320, 480),
        )

# Initializations for SDCard
spi = busio.SPI(board.SCK, board.MOSI, board.MISO)
sdcard = sdcardio.SDCard(spi, board.SD_CS)
vfs = storage.VfsFat(sdcard)
storage.mount(vfs, "/sd")
sys.path.append("/sd")

# debugging, print files that exist on SDCard
# print(os.listdir("/sd"))

# get reference to the display
display = board.DISPLAY

# set rotation
display.rotation = ORIENTATION

# Initialize WinampApplication helper class
winamp_application = WinampApplication(
    playlist_file=PLAYLIST_FILE,
    skin_image=SKIN_IMAGE,
    skin_config_file=SKIN_CONFIG_FILE,
    pyportal_titano=PYPORTAL_TITANO,
)

# Add the Group to the Display
display.root_group = winamp_application

# previous iteration touch events
_previous_touch = None

# last time a touch occured
_previous_touch_time = 0

# main loop
while True:
    # update winamp application
    winamp_application.update()

    # check for touch events
    p = ts.touch_point
    _now = time.monotonic()
    # if touch cooldown time has elapsed
    if _now >= _previous_touch_time + TOUCH_COOLDOWN:
        # if there is a touch
        if p and not _previous_touch:
            # store the time to compare with next iteration
            _previous_touch_time = _now
```

```
            # if touch is on bottom half
            if p[1] > SIZE[1] // 2:
                # if touch is on right half
                if p[0] >= SIZE[0] // 2:
                    winamp_application.next_track()

                # if touch is on left half
                else:
                    winamp_application.previous_track()
            # if touch is on top half
            else:
                # if currently playing song
                if winamp_application.CURRENT_STATE ==
winamp_application.STATE_PLAYING:
                    print("pausing")
                    winamp_application.pause()

                # if song is paused
                else:
                    print("resuming")
                    winamp_application.resume()

    # store previous touch event t compare with next iteration
    _previous_touch = p
```

winamp_helpers.py:

```
# SPDX-FileCopyrightText: 2022 Tim C, written for Adafruit Industries
#
# SPDX-License-Identifier: Unlicense
"""
PyPortal winamp displayio widget classes.
"""
import os
import time
import json
import board
import displayio
import terminalio
from audioio import AudioOut
from audiomp3 import MP3Decoder
from adafruit_display_text import bitmap_label, scrolling_label


class WinampApplication(displayio.Group):
    """
    WinampApplication

    Helper class that manages song playback and UI components.

    :param playlist_file: json file containing the playlist of songs
    :param skin_image: BMP image file for skin background
    :param skin_config_file: json file containing color values
    :param pyportal_titano: boolean value. True if using Titano, False otherwise.
    """

    STATE_PLAYING = 0
    STATE_PAUSED = 1
    # pylint: disable=too-many-statements,too-many-branches
    def __init__(
        self,
        playlist_file="playlist.json",
        skin_image="/base_240x320.bmp",
        skin_config_file="base_config.json",
```

```
        pyportal_titano=False,
    ):
        self.SKIN_IMAGE = skin_image
        self.SKIN_CONFIG_FILE = skin_config_file
        self.PLAYLIST_FILE = playlist_file

        # read the skin config data into variable
        f = open(self.SKIN_CONFIG_FILE, "r")
        self.CONFIG_DATA = json.loads(f.read())
        f.close()

        if self.PLAYLIST_FILE:
            try:
                # read the playlist data into variable
                f = open(self.PLAYLIST_FILE, "r")
                self.PLAYLIST = json.loads(f.read())
                f.close()
            except OSError:
                # file not found
                self.auto_find_tracks()
            except ValueError:
                # json parse error
                self.auto_find_tracks()
        else:
            # playlist file argument was None
            self.auto_find_tracks()

        if self.PLAYLIST:
            try:
                if len(self.PLAYLIST["playlist"]["files"]) == 0:
                    # valid playlist json data, but no tracks
                    self.auto_find_tracks()
            except KeyError:
                self.auto_find_tracks()

        # initialize clock display
        self.clock_display = ClockDisplay(text_color=self.CONFIG_DATA["time_color"])
        if not pyportal_titano:
            # standard PyPortal and pynt clock display location
            # and playlist display parameters
            self.clock_display.x = 44
            self.clock_display.y = 22
            _max_playlist_display_chars = 30
            _rows = 3
        else:
            # PyPortal Titano clock display location
            # and playlist display parameters
            self.clock_display.x = 65
            self.clock_display.y = 37
            _max_playlist_display_chars = 42
            _rows = 4

        # initialize playlist display
        self.playlist_display = PlaylistDisplay(
            text_color=self.CONFIG_DATA["text_color"],
            max_chars=_max_playlist_display_chars,
            rows=_rows,
        )
        if not pyportal_titano:
            # standard PyPortal and pynt playlist display location
            self.playlist_display.x = 13
            self.playlist_display.y = 234
        else:
            # PyPortal Titano playlist display location
            self.playlist_display.x = 20
            self.playlist_display.y = 354

        # set playlist into playlist display
        self.playlist_display.from_files_list(self.PLAYLIST["playlist"]["files"])
```

```
        self.playlist_display.current_track_number = 1

        # get name of current song
        self.current_song_file_name = self.PLAYLIST["playlist"]["files"][
            self.playlist_display.current_track_number - 1
        ]

        if not pyportal_titano:
            # standard PyPortal and pynt max characters for track title
            _max_chars = 22
        else:
            # PyPortal Titano max characters for track title
            _max_chars = 29
        # initialize ScrollingLabel for track name
        self.current_song_lbl = scrolling_label.ScrollingLabel(
            terminalio.FONT,
            text=self.playlist_display.current_track_title,
            color=self.CONFIG_DATA["text_color"],
            max_characters=_max_chars,
        )
        self.current_song_lbl.anchor_point = (0, 0)
        if not pyportal_titano:
            # standard PyPortal and pynt track title location
            self.current_song_lbl.anchored_position = (98, 19)
        else:
            # PyPortal Titano track title location
            self.current_song_lbl.anchored_position = (130, 33)

        # Setup the skin image file as the bitmap data source
        self.background_bitmap = displayio.OnDiskBitmap(self.SKIN_IMAGE)

        # Create a TileGrid to hold the bitmap
        self.background_tilegrid = displayio.TileGrid(
            self.background_bitmap, pixel_shader=self.background_bitmap.pixel_shader
        )

        # initialize parent displayio.Group
        super().__init__()

        # Add the TileGrid to the Group
        self.append(self.background_tilegrid)

        # add other UI componenets
        self.append(self.current_song_lbl)
        self.append(self.clock_display)
        self.append(self.playlist_display)

        # Start playing first track
        self.current_song_file = open(self.current_song_file_name, "rb")
        self.decoder = MP3Decoder(self.current_song_file)
        self.audio = AudioOut(board.SPEAKER)
        self.audio.play(self.decoder)

        self.CURRENT_STATE = self.STATE_PLAYING

        # behavior variables.
        self._start_time = time.monotonic()
        self._cur_time = time.monotonic()
        self._pause_time = None
        self._pause_elapsed = 0
        self._prev_time = None
        self._seconds_elapsed = 0
        self._last_increment_time = 0

    def auto_find_tracks(self):
        """
        Initialize the song_list by searching for all MP3's within
        two layers of directories on the SDCard.
```

```
        e.g. It will find all of:
        /sd/Amazing Song.mp3
        /sd/[artist_name]/Amazing Song.mp3
        /sd/[artist_name]/[album_name]/Amazing Song.mp3

        but won't find:
        /sd/my_music/[artist_name]/[album_name]/Amazing Song.mp3

        :return: None
        """
        # list that holds all files in the root of SDCard
        _root_sd_all_files = os.listdir("/sd/")

        # list that will hold all directories in the root of the SDCard.
        _root_sd_dirs = []

        # list that will hold all subdirectories inside of root level directories
        _second_level_dirs = []

        # list that will hold all MP3 file songs that we find
        _song_list = []

        # loop over all files found on SDCard
        for _file in _root_sd_all_files:
            try:
                # Check if the current file is a directory
                os.listdir("/sd/{}".format(_file))

                # add it to a list to look at later
                _root_sd_dirs.append(_file)
            except OSError:
                # current file was not a directory, nothing to do.
                pass

            # if current file is an MP3 file
            if _file.endswith(".mp3"):
                # we found an MP3 file, add it to the list that will become our
playlist
                _song_list.append("/sd/{}".format(_file))

        # loop over root level directories
        for _dir in _root_sd_dirs:
            # loop over all files inside of root level directory
            for _file in os.listdir("/sd/{}".format(_dir)):

                # check if current file is a directory
                try:
                    # if it is a directory, loop over all files inside of it
                    for _inner_file in os.listdir("/sd/{}/{}".format(_dir, _file)):
                        # check if inner file is an MP3
                        if _inner_file.endswith(".mp3"):
                            # we found an MP3 file, add it to the list that will
become our playlist
                            _song_list.append(
                                "/sd/{}/{}/{}".format(_dir, _file, _inner_file)
                            )
                except OSError:
                    # current file is not a directory
                    pass
                # if the current file is an MP3 file
                if _file.endswith(".mp3"):
                    # we found an MP3 file, add it to the list that will become our
playlist
                    _song_list.append("/sd/{}/{}".format(_dir, _file))

        # format the songs we found into the PLAYLIST data structure
        self.PLAYLIST = {"playlist": {"files": _song_list}}

        # print message to user letting them know we auto-generated the playlist
```

```
        print("Auto Generated Playlist from MP3's found on SDCard:")
        print(json.dumps(self.PLAYLIST))

    def update(self):
        """
        Must be called each iteration from the main loop.
        Responsible for updating all sub UI components and
        managing song playback

        :return: None
        """
        self._cur_time = time.monotonic()
        if self.CURRENT_STATE == self.STATE_PLAYING:
            # if it's time to increase the time on the ClockDisplay
            if self._cur_time >= self._last_increment_time + 1:
                # increase ClockDisplay by 1 second
                self._seconds_elapsed += 1
                self._last_increment_time = self._cur_time
                self.clock_display.seconds = int(self._seconds_elapsed)

        # update the track label (scrolling)
        self.current_song_lbl.update()

        if self.CURRENT_STATE == self.STATE_PLAYING:
            # if we are supposed to be playing but aren't
            # it means the track ended.
            if not self.audio.playing:
                # start the next track
                self.next_track()

        # store time for comparison later
        self._prev_time = self._cur_time

    def play_current_track(self):
        """
        Update the track label and begin playing the song for current
        track in the playlist.

        :return: None
        """
        # set the track title
        self.current_song_lbl.full_text = self.playlist_display.current_track_title

        # save start time in a variable
        self._start_time = self._cur_time

        # if previous song is still playing
        if self.audio.playing:
            # stop playing
            self.audio.stop()

        # close previous song file
        self.current_song_file.close()

        # open new song file
        self.current_song_file_name = self.PLAYLIST["playlist"]["files"][
            self.playlist_display.current_track_number - 1
        ]
        self.current_song_file = open(self.current_song_file_name, "rb")
        self.decoder.file = self.current_song_file

        # play new song file
        self.audio.play(self.decoder)

        # if user paused the playback
        if self.CURRENT_STATE == self.STATE_PAUSED:
            # pause so it's loaded, and ready to resume
            self.audio.pause()
```

```
    def next_track(self):
        """
        Advance to the next track.
        :return: None
        """
        # reset ClockDisplay to 0
        self._seconds_elapsed = 0
        self.clock_display.seconds = int(self._seconds_elapsed)

        # increment current track number
        self.playlist_display.current_track_number += 1

        try:
            # start playing track
            self.play_current_track()
        except OSError as e:
            # file not found
            print("Error playing: {}".format(self.current_song_file_name))
            print(e)
            self.next_track()
            return

    def previous_track(self):
        """
        Go back to previous track.

        :return: None
        """
        # reset ClockDisplay to 0
        self._seconds_elapsed = 0
        self.clock_display.seconds = int(self._seconds_elapsed)

        # decrement current track number
        self.playlist_display.current_track_number -= 1

        try:
            # start playing track
            self.play_current_track()
        except OSError as e:
            # file not found
            print("Error playing: {}".format(self.current_song_file_name))
            print(e)
            self.previous_track()
            return

    def pause(self):
        """
        Stop playing song and wait until resume function.

        :return: None
        """
        if self.audio.playing:
            self.audio.pause()
        self.CURRENT_STATE = self.STATE_PAUSED

    def resume(self):
        """
        Resume playing song after having been paused.

        :return: None
        """
        self._last_increment_time = self._cur_time
        if self.audio.paused:
            self.audio.resume()
        self.CURRENT_STATE = self.STATE_PLAYING


class PlaylistDisplay(displayio.Group):
    """
```

```
    PlaylistDisplay

    Displayio widget class that shows 3 songs from the playlist.
    It has functions to help manage which song is currently at the
    top of the list.

    :param text_color: Hex color code for the text in the list
    :param song_list: Song names in the list
    :param current_track_number: initial track number shown at the top of the list.l
    :param max_chars: int max number of characters to show in a row. Excess
characters are cut.
    :param rows: how many rows to show. One track per row. Default 3 rows
    """

    def __init__(
        self, text_color, song_list=None, current_track_number=0, max_chars=30,
rows=3
    ):
        super().__init__()

        self._rows = rows
        if song_list is None:
            song_list = []
        self._song_list = song_list
        self._current_track_number = current_track_number

        self._max_chars = max_chars

        # the label to show track titles inside of
        self._label = bitmap_label.Label(terminalio.FONT, color=text_color)

        # default position, top left inside of the self instance group
        self._label.anchor_point = (0, 0)
        self._label.anchored_position = (0, 0)
        self.append(self._label)

        # initial refresh to show the songs
        self.update_display()

    def update_display(self):
        """
        refresh the label to show the current tracks based on current track number.

        :return: None
        """

        # get the current track plus the following 2
        _showing_songs = self.song_list[
            self.current_track_number - 1 : self.current_track_number + self._rows -
1
        ]

        # format the track titles into a single string with newlines
        _showing_string = ""
        for index, song in enumerate(_showing_songs):
            _cur_line = "{}. {}".format(
                self.current_track_number + index, song[: self._max_chars]
            )
            _showing_string = "{}{}\n".format(_showing_string, _cur_line)

        # put it into the label
        self._label.text = _showing_string

    @property
    def song_list(self):
        """

        :return: the list of songs
        """
```

```
        return self._song_list

    @song_list.setter
    def song_list(self, new_song_list):
        self._song_list = new_song_list
        self.update_display()

    def from_files_list(self, files_list):
        """
        Initialize the song_list from a list of filenames.
        Directories and MP3 file extension will be removed.

        :param files_list: list of strings containing filenames
        :return: None
        """
        _song_list = []
        for _file in files_list:
            _song_list.append(_file.split("/")[-1].replace(".mp3", ""))
        self.song_list = _song_list

    @property
    def current_track_number(self):
        """
        Track number is 1 based. Track number 1 is the first one in the playlist.
        Autowraps from 0 back to last song in the playlist.

        :return: current track number
        """
        return self._current_track_number

    @current_track_number.setter
    def current_track_number(self, new_index):
        if new_index <= len(self.song_list):
            if new_index != 0:
                self._current_track_number = new_index
            else:
                self._current_track_number = len(self.song_list)
        else:
            self._current_track_number = new_index % len(self.song_list)
        self.update_display()

    @property
    def current_track_title(self):
        """

        :return: Current track title as a formatted string with the track number
pre-pended.

        e.g. "1. The Greatest Song"
        """

        if self.current_track_number == 0:
            return "1. {}".format(self.song_list[0])
        else:
            return "{}. {}".format(
                self.current_track_number, self.song_list[self.current_track_number
- 1]
            )


class ClockDisplay(displayio.Group):
    """
    DisplayIO widget to show an incrementing minutes and seconds clock.
    2 digits for minutes, and 2 digits for seconds. Values will get
    zero padded. Does not include colon between the values.

    :param text_color: Hex color code for the clock text
    """
```

```
    def __init__(self, text_color):
        super().__init__()

        # seconds elapsed to show on the clock display
        self._seconds = 0

        # Minutes tens digit label
        self.first_digit = bitmap_label.Label(terminalio.FONT, color=text_color)
        self.first_digit.anchor_point = (0, 0)
        self.first_digit.anchored_position = (0, 0)
        self.append(self.first_digit)

        # Minutes ones digit label
        self.second_digit = bitmap_label.Label(terminalio.FONT, color=text_color)
        self.second_digit.anchor_point = (0, 0)
        self.second_digit.anchored_position = (10, 0)
        self.append(self.second_digit)

        # Seconds tens digit label
        self.third_digit = bitmap_label.Label(terminalio.FONT, color=text_color)
        self.third_digit.anchor_point = (0, 0)
        self.third_digit.anchored_position = (26, 0)
        self.append(self.third_digit)

        # Seconds ones digit label
        self.fourth_digit = bitmap_label.Label(terminalio.FONT, color=text_color)
        self.fourth_digit.anchor_point = (0, 0)
        self.fourth_digit.anchored_position = (36, 0)
        self.append(self.fourth_digit)

        # initialize showing the display
        self.update_display()

    @property
    def seconds(self):
        """
        :return: the seconds elapsed currently showing
        """
        return self._seconds

    @seconds.setter
    def seconds(self, new_seconds_value):
        """
        Save new seconds elapsed and update the display to reflect it.

        :param new_seconds_value: the new seconds elapsed to show
        :return: None
        """
        self._seconds = new_seconds_value
        self.update_display()

    def update_display(self):
        """
        Update the text in the labels to reflect the current seconds elapsed time.

        :return: None
        """
        # divide to get number of minutes elapsed
        _minutes = self.seconds // 60

        # modulus to get number of seconds elapsed
        # for the partial minute
        _seconds = self.seconds % 60

        # zero pad the values and format into strings
        _minutes_str = f"{_minutes:02}"
        _seconds_str = f"{_seconds:02}"

        # update the text in the minutes labels
```

```
        if self.first_digit.text != _minutes_str[0]:
            self.first_digit.text = _minutes_str[0]
        if self.second_digit.text != _minutes_str[1]:
            self.second_digit.text = _minutes_str[1]

        # update the text in the seconds label
        if self.third_digit.text != _seconds_str[0]:
            self.third_digit.text = _seconds_str[0]
        if self.fourth_digit.text != _seconds_str[1]:
            self.fourth_digit.text = _seconds_str[1]
```

Custom Winamp Skin

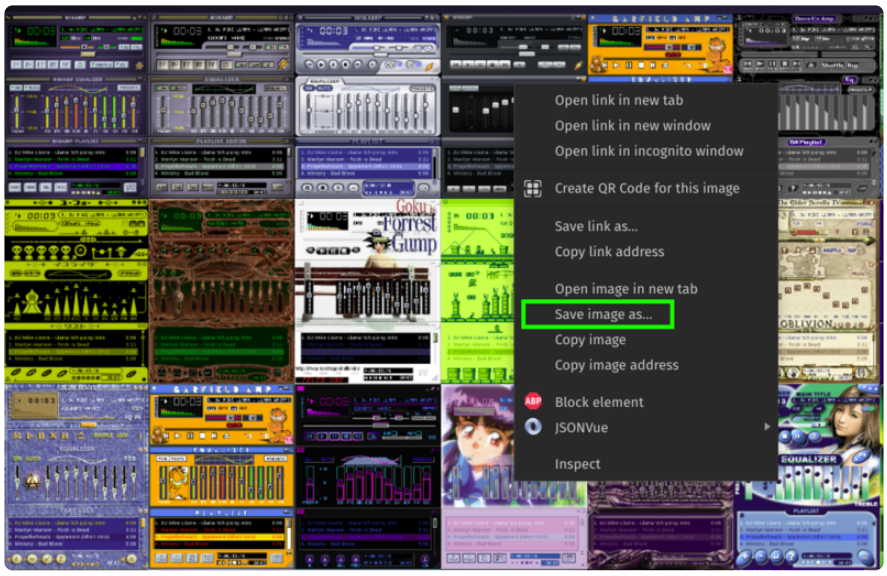
Both The Winamp Skin Museum (https://adafru.it/YBo) and the Internet Archive (https://adafru.it/1afR) contain many different skins. Take a look through them, find something that suits your style, you can download it and convert it for use on your PyPortal.

Inside the project bundle that you downloaded there is a directory named **PyPortal_Winamp_Skin_Converter**. Inside of there is a Python script that will do the conversion for you.

> The next several steps need to be done on your PC, not the PyPortal device.

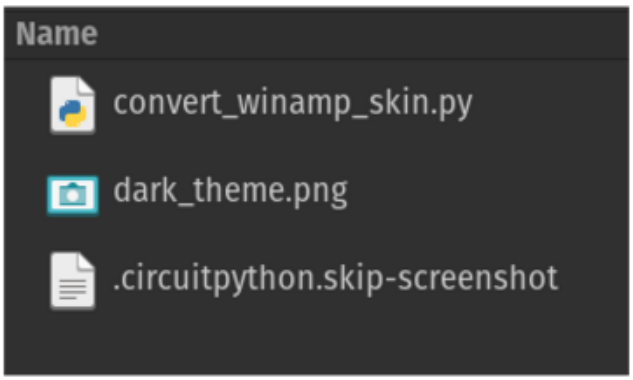
Download Skin

Go to the Skin Museum (https://adafru.it/YBo) or the Internet Archive (https://adafru.it/1afR) and find the perfect skin. Once you find it, right click on its preview image and download the image.



The downloaded file should be a PNG image. If your downloaded file is a ZIP file then you accidentally downloaded the one that gets used with the real Winamp player. For our PyPortal we need the PNG preview image only. Right click from the main "grid" page on the skin you like to download the preview image.

By default the filename will be a long string of letters and numbers. You should change it to something shorter and more descriptive, especially if you plan to download multiple skins and swap them out! The skin I chose is a dark theme so I'll choose the name **dark_theme.png**. You can choose a name that is appropriate for the skin you chose.



Once you've downloaded the skin image copy it into the **PyPortal_Winamp_Skin_Converter** directory on your PC. It should be alongside of **convert_winamp_skin.py**. There is a **.circuitpython.skip-screenshot** file there also, but you don't need to use it. That is for our project files screenshot utility.

Convert the skin

The conversion script requires Python (https://adafru.it/deW) and the Pillow (https://adafru.it/FUR) library, which is a friendly fork of PIL the Python Imaging Library.

If you don't already have Python on your PC, go to the Python downloads (https://adafru.it/fa7) page and follow the instructions there to download Python for your PC.

Once you've got Python on your PC you can use pip to install pillow. Run this command to install it:

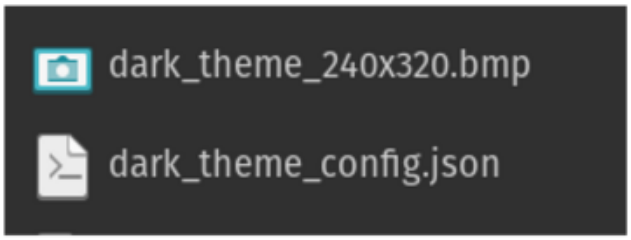
```
pip install pillow
```

Once you've got pillow installed you are ready to convert the skin. To convert it run a command like this, substituting in the name of the skin image file that you downloaded.

```
python convert_winamp_skin.py [your_skin_image].png
```

So for my dark theme skin I am running this command:

```
python convert_winamp_skin.py dark_theme.png
```



Skin files

This will create two files from your skin. These will get loaded onto your **CIRCUITPY** drive. They will be named like these: **[your_skin]_240x320.bmp** and **[your_skin]_config.j**

Copy both of these two files to your PyPortal **CIRCUITPY** drive.

The last thing to do is update the variables near the top of **code.py** on your **CIRCUITPY** drive to reflect your skin filenames. This is how mine look, yours will use the name that you selected previously.

```
# which skin background to use
SKIN_IMAGE = "/dark_theme_240x320.bmp"

# skin configuration for color values
SKIN_CONFIG_FILE = "dark_theme_config.json"
```

The PyPortal will reset when you save the files and draw the new skin and begin playing your playlist. You can download several skins and swap between them for whatever mood you're in.