Python Radio 4: Sending Music

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MidJourney

In the previous project:

Python Radio: Simple Beginnings

The simplest digital radio mode

Medium.com

We used the PWM feature of the ESP8266 to send a 1,000 Hertz tone over the air to form the dots and dashes of Morse code.

That was as high a frequency as our little ESP8266 can manage with the PWM feature (unlike its big brother, the ESP32 which can manage up to 40 megahertz).

But we can send tones of a lower pitch if we like. This allows us to play the kind of music we used to hear on early computer games and phones.

There is a format that phones used to use for storing their ringtones. It is called the Ring Tone Text Transfer Language, or RTTTL. Dave Hylands wrote a parser for this language for MicroPython, which you can see here.

Ringtones contain notes that are higher than 1,000 Hertz, but we can shift them two octaves down easily by dividing the frequency by 4. The program to send them over the air using the same simple FS1000A and XY-MK-5V circuits that we used when sending Morse looks like this:

From rtttl import RTTTL

From time import sleep\_ms, sleep

From machine import Pin, PWM

PIN\_D4 = 2

Key = PWM(Pin(PIN\_D4))

Def play\_tone(freq, msec):

If freq > 0:

Key.freq(int(freq/4)) # Set frequency (divide by 4 because we can’t go higher than 1000 Hz)

Key.duty(512) # 50% duty cycle

Sleep\_ms(int(0.9 \* msec)) # Play for a number of msec

Key.duty(0) # Stop playing for gap between notes

Sleep\_ms(int(0.1 \* msec)) # Pause for a number of msec

While(True):

With open(’tunes.txt’) as f:

For song in f:

Print(song.split(”:”)[0])

Tune = RTTTL(song)

For freq, msec in tune.notes():

Play\_tone(freq, msec)

Sleep(1)

We import Dave’s RTTTL class from the module rtttl.py.

We create a function play\_tone() that uses the PWM pin to send the note or a quiet period.

The main code loops forever, opening the file tunes.txt from the file system in flash on the ESP8266.

That file contains several ringtones, one per line, in the RTTTL format.

Dave’s RTTTL class hands us pairs of frequency and time to hand to our play\_tone function.

We sleep for a second in between songs.

All of the files needed can be found here: <https://scitoys.com/pythonradio/ringtones.zip>. There is a setup.cmd file to put MicroPython onto the ESP8266 and copy the files onto it.

Set comport=%1

Esptool –port %comport% erase\_flash

Esptool.exe –port %comport% write\_flash -fm dio -fs 16MB 0 firmware.bin

Send\_files %comport%

Putty -load %comport%

To use it, save it as setup.cmd and type:

Setup com3

If you just wish to repurpose the previous project, you can simply use the send\_files.cmd script to put the files in place, since MicroPython will already be loaded onto the board.

Set comport=%1

Ampy -p %comport% put webrepl\_cfg.py

Ampy -p %comport% put boot.py

Ampy -p %comport% put main.py

Ampy -p %comport% put rtttl.py

Save it as send\_files.cmd and type:

Send\_files com3

The tunes.txt file contains a short list (about 39) of ringtones, selected from a list of 10,000 of them that can be found here: <https://scitoys.com/pythonradio/rtttl3.zip>.

1812Over:d=4,o=6,b=355:8b5,8b5,e,f#,g#,f#,e,f#,2g#,2e,1e.,8b5,8b5,e,f#,g#,f#,e,f#,2g#,2e,1e.,8c#,8c#,f#,g#,f#,c#,a5,c#,f#,c#,a5,c#,1f#.,8b5,16b.5,e,f#,e,b5,g#5,b5,e,c#,g#5,c#,1e.,8c#.,8c#,8c#.,2e,1c#,8b.5,b5,8b.5,2d#,1b5,b5,b5,8b.5,2c#,2e,2d#,2f#,2e,b.,a#.,a.,g#.,2g,2f#,f.,2e,d#.,d.,2c#,1b5,1c,1c#,1d#,1e,2f#,2d#,1e,2f#,2d#,2e,2d#,2e,2d#,2e,2d#,2e,2d#,1e.

AintNoSu:d=4,o=7,b=120:8a6,c,d,f.,e,c,1d,2a5,2c6,2d6,8a6,c,d,f.,e.,8c,1d,2a5,2c6,2d6,8d,d,f,a.,8g,8a,2g.,8p,8f,8g,f.,d,c,d,2d,8f,8g,2f.,8d,c,8d,1d,2a5,2c6,d6

AllShook:d=4,o=5,b=225:8c,f,8p,8f,p,f,8c,d,8c,f,f,8p,8f,2p,8p,8c,f,8p,8f,p,f,8c,d,8c,f,f,8p,8f,2p,8p,8c,f,8p,8f,p,f,8c,d,8c,f,f,8p,8f,p,8c,d,8c,f,1p,8p,8f,f,f,8p,8f,p,8c,d,8f,1p,p,8p,8g,1p,p,8p,g#.,1f

BabyYouC:d=8,o=5,b=140:p,a,c6,a,f,a,4f,2g#.,4p,p,a,c6,a,f,a,4f,2g#.,4p,p,a,c6,a,f,a,4f,4g#,4p,c,d,f,d,4g#,d,2f,4p,p,d#6,d#6,p,d#6,d#6,p,2f6

BeachBoy:d=2,o=6,b=225:a#.5,g.,d#.,a#.5,c.,g#.,1f.,d.,a#.,g.,f.,d#.,c.7,1g#.,a#.5,g.,d#.,a#.5,c.,f.,d.,f.,1d#.

BeatItV1:d=4,o=5,b=100:8c#6,16f#6,16g#6,16d#7,8c#7,16p,8d#7,16c#7,16a#6,16p,16a#6,8p,16f#6,16g#6,16d#7,8c#7,16p,8d#7,16c#7,16a#6

BillieJe:d=16,o=6,b=125:8e,8e,8d,4p,8b5,32e,p,32p,4e,4d,2p,32e,p,32p,32e,p,32p,8e,8d,4p,8b5,8e,8g,p,32p,4a,8g,8f#,2e,8p,p,8e,8p,8e,4b,4a,8e,4c,2b5,b,g,e,c,2b5

BlackDog:d=4,o=5,b=100:16g#6,16a#6,16a#6,16c#7,16g#6,8d#7,8c#7,16f#7,16g#7,8d#7,8c#7,8d#7,16a#6,16c#7,16c#7,16f#6,16g#6,16f#6,16f#6,16c#6,8c#6

Bourree:d=8,o=6,b=140:e,f#,4g,32p,16g,32g,32f#,e,4d#,e,f#,4b5,c#,d#,4e,d,c,4b5,a5,g5,4f#5,g5,a5,b5,a5,g5,f#5,4e5,32p,e,f#,4g,32p,16g,32g,32f#,e,4d#,e,f#,4b5,c#,d#,4e,d,c,4b5,a5,g5,32f#5,32e5,32f#5,4f#5,32p,g5,2g.5

Californ:d=16,o=6,b=50:32p,32f,f.,d#.,c#,c.,c#.,g#.5,a#.5,32a#5,c#.,b.5,c#.,b.5,a#.5,b5,32a#5,8g#.5,d#,32c#,e.,d#.,c#,32c#,d#,32d#,a5,32a5,d#,c#.,32f#,f#,32f#,f#.,f.,d#,f.,4g#5,32f,f.,d#.,c#,c.,c#.,g#.5,a#.5,32a#5,c#.,b.5,c#.,b.5,a#.5,b5,32a#5,8g#.5,d#,32c#,e.,d#.,c#,32c#,d#,32d#,a5,32a5,d#,c#.,32f#,f#,32f#,f#.,f.,d#,f.,4g#5

Camptown:d=4,o=5,b=180:g,g,e,g,a,g,2e,e,2d.,e,2d.,g,g,e,g,a,g,2e,2d,e,d,1c,c.,8c,e,g,1c6,a.,8a,c6,a,1g,g,g,8e,8e,8g,8g,a,g,2e,d,8e,8f,e,8e,8d,2c,2p

Cecilia:d=8,o=5,b=200:16c6,p,2c6,2g#.,16c6,p.,16c#6,p.,16c6.,p.,16a#,p.,2c6.,p.,16c6,p.,16c#6,p.,16c6.,p.,16a#,p.,4c6.,p.,16a#,p.,16g#,p.,4a#.,16g,16f.,4d#.,4p,2g#,16c6,p,2c6,2g#.,16c6,p.,16c#6,p.,16c6.,p.,16a#,p.,2c6.,p.,16c6,p.,16c#6,p.,16c6.,p.,16a#,p.,4c6.,p.,16a#,p.,16g#,p.,4a#.,16g,16f.,d#.

DontStop:d=4,o=5,b=125:16d7,16c#7,16c7,16b6,16a6,16b6,16c7,16c#7,16d7,16c7,16b6,8a6,16p,16a,16b,16c6,16b,16a,16p,16c6,16b,16a,16p,16c6,16b,16a#,8a,16p,16c7,16c#7,16d7,16c#7,16c7,16b6,16a6,16b6,16c7,16c#7,16d7,16c7,16b6,16a6,16p,16d6,16p,16d6,16d6,16d6,16d6,16d6,16d6,16d6,16a,16p,16c6,16d6,16p,16d6,16c6,16b,16a#,16a

DownOnTh:d=4,o=5,b=100:8f#6,16p,16d#6,16p,16c#6,16p,8f#6,16p,8f#6,16p,16d#6,16p,8c#6,8p,16p,16e#6,16p,8f#6,16p,8f#6

FunFunFu:d=32,o=6,b=40:32p,16d,c,d,d,c,c,d#,d#,d,d,c,c,a5,a5,c,c,f,16g,4f,d,d,c,d,d,c,16d#,d#,d,d,c,c,a5,a5,c,d,c,16c,4g5,d,d,c,d,d,c,16d#,d#,16d,c,c,a5,a5,c,c,f,16g,4f

GodOnlyK:d=32,o=6,b=140:8d,p,16c#.,8d,p,4c#,4b5,4f#5,2b.5,16g#.5,8a5,p,16g#.5,8a5,p,4c#,4f#,16a.5,8b5,p,2c#.,16p,p,8e,p,16d#.,8e,p,4f#.,8a5,4b5,2c#.,16e.,8e,p,16d#.,8e,p,4g#.,8c#,4d#,2e.,16p,p,8c#,p,16b.5,8c#,p,4b5,4e,16b.5,4a5,8g#5,p,4e5,2f#.5

HeyJude:d=4,o=5,b=100:8g#6,8e#6,16p,16e#6,16e#6,16g#6,16a#6,8d#6,16p,16d#6,16e#6,8f#6,16c#7,16c#7,16c#6,16g#6,16a#6,16g#6,16f#6,8e#6,16p,16g#6,16a#6,16a#6,16d#7,16c#7,16c#6,16c#6,16c#7,16a#6,8g#6,16p,16c#6,16d#6,16e#6,16a#6,8g#6

ICan’tGe:d=8,o=5,b=140:d,p,4d.,d,e,4f.,p,f,f,e,e,d,d,p,4d.,d,e,4f.,p,f,f,e,e,d,d,p,4d.,d,e,4f.,p,f,f,e,e,d,d,p,4d.,d,e,4f.,p,f,f,e,e,d

In-A-Gad:d=4,o=6,b=28:32p,16d#5,16d#5,32f#5,32f5,32c#5,16d#5,16a#5,16a5,16g#5,32f#5,16d#5,16d#5,32f#5,32f5,32c#5,16d#5,16a#5,16a5,16g#5,32f#5,16d#5,16d#5,32f#5,32f5,32c#5,16d#5,16a#5,16a5,16g#5,32f#5,16d#5,16d#5,32f#5,32f5,32c#5,16d#5,16a#5,16a5,16g#5,32f#5,16d#5,16d#5

IndianaJ:d=4,o=5,b=250:e,8p,8f,8g,8p,2c.6,8p.,d,8p,8e,1f,p.,g,8p,8a,8b,8p,2f.6,p,a,8p,8b,2c6,2d6,2e6,e,8p,8f,8g,8p,1c6,p,d6,8p,8e6,1f6,g,8p,8g,e.6,8p,d6,8p,8g,e.6,8p,d6,8p,8g,f.6,8p,e6,8p,8d6,1c6

JamesBon:d=4,o=6,b=56:16c#5,16e5,32c,8b5,32e5,32g.5,g#5,32e.5,32f#5,32e5,8d#5,32g#4,32c#.5,a#4,16c#5,16e5,32c,8b5,32e5,32g.5,g#5,32e.5,32f#5,32e5,8d#5,32g#4,32c.5,c#.5

LaCucara:d=16,o=5,b=100:c,c,c,8f.,a,p,c,c,c,8f.,a,4p,f,f,e,e,d,d,8c,p,c,c,c,8e.,g,p,c,c,c,8e.,g,4p,c6,d6,c,a,g,8f

Minuet:d=8,o=5,b=125:4d6,g,a,b,c6,4d6,4g,4g,4e6,c6,d6,e6,f6,4g6,4g,4g,4c6,d6,c6,b,a,4b,c6,b,a,g,4f#,g,a,b,g,4b,4a

Money:d=8,o=5,b=180:4g,p,4g6,d6,g,4p,4d,p,4f,p,4g,p,4a,p,4g,p,4g6,d6,g,4p,4d,p,4f,p,4g,p,4a,p,4g,p,4g6,d6,g,4p,4d,p,4f,p,4g,p,4a,p,4g,p,4g6,d6,g,4p,4d,p,4f,p,4g,p,d6,16p.,d6,2p.,4a,a,4g6

MontyPyt:d=4,o=6,b=45:16g.5,16g.5,16g5,16g.5,32e5,8g.5,16e5,32d5,16e5,8g.5,32d,8b.5,32f#5,16e5,32f#5,16g5,32b5,32a5

PaintItB:d=4,o=5,b=31:32f#.,32g#.,32a.,32b.,32a.,32g#.,32f#.,32f#.,32f.,32f#,32g#.,32f#.,8f.,32f#.,32g#.,32a.,32b.,32a.,32g#.,32f#.,32f#.,32f.,32f#,32g#.,32f#.,8f.

Paperbac:d=8,o=6,b=112:4c.7,d7,2e7,2e7,2d7,4b.7,g7,2g7,2g7,2e7,g5,b5,d,4g,g5,4f,g5,4c,g5,16c,d.,4f,g5,b5,d,4g,g5,4f,g5,4c,g5,16c,d.,4f

SailorsH:d=8,o=5,b=200:f6,e6,4f6,f.,32p,4f,c6,a#,a,c6,f6.,32p,4f6,g6,f#6,4g6,g.,32p,4g,g6,f6,e6,d6,c6.,32p,4c6,d6,e6,f6,e6,d6,c6,d6,c6,a#,a,a#,a,g,f,g,f,e,d,c,d,e,f,g,a#,a,g,4a,4f,4f.

Satisfac:d=4,o=6,b=140:8a5,8p,a5,16d5,16p,8a5,8b5,c.,16d5,16p,8c,8c,8b5,8c,8b5,8a5,8p,a5,16d5,16p,8a5,8b5,c.,16d5,16p,8c,8c,8b5,8c,8b5,8a5,8p,a5,16d5,16p,8a5,8b5,c.,16d5,16p,8c,8c,8b5,8c,8b5,8a5,8p,a5,16d5,16p,8a5,8b5,c.,16d5,16p,8c,8c,8b5,8c,8b5,8a5,8p,a5,16d5,16p,8a5,8b5,c.,16d5,16p,8c,8c,8b5,8c,8b5,d5

SmokeOnT:d=4,o=5,b=112:4c5,4d#5,4f.5,4c5,4d#5,8f#5,4f5,4p,4c5,4d#5,4f.5,4d#5,4c5,2p,8p,4c5,4d#5,4f.5,4c5,4d#5,8f#5,4f5,4p,4c5,4d#5,4f.5,4d#5,4c5

StarWars:d=4,o=5,b=250:8a,8p,8d6,8p,8a,8p,8d6,8p,8a,8d6,8p,8a,8p,8g#,a,8a,8g#,8a,g,8f#,8g,8f#,f.,8d.,16p,p.,8a,8p,8d6,8p,8a,8p,8d6,8p,8a,8d6,8p,8a,8p,8g#,8a,8p,8g,8p,g.,8f#,8g,8p,8c6,a#,a,g

StayingA:d=16,o=5,b=100:c6,8p.,a#,8p.,g#,8p.,g,8p,p,g,g#,g#,g#,4p,g,g#,g#,g#,4p,c6,8p.,a#,8p,p,g#,8p.,g,8p,p,g#,g#,g#,2c.6,p,1a#,1g#,1g

Theme:d=4,o=5,b=112:16g6,8p,16g6,8p,16f6,16p,16f#6,16p,16g6,8p,16g6,8p,16a#6,16p,16c7,16p,16g6,8p,16g6,8p,16f6,16p,16f#6,16p,16g6,8p,16g6,8p,16a#6,16p,16c7,16p,16a#6,16g6,2d6,32p,16a#6,16g6,2c#6,32p,16a#6,16g6,2c6,16p,16a#,16c6

TubularB:d=4,o=6,b=200:8b,8e,8a,8e,8b,8e,8g,8a,8e,8c7,8e,8d7,8e,8b,8c7,8e,8b,8e,8a,8e,8b,8e,8g,8a,8e,8c7

WalkOnTh:d=16,o=5,b=100:8p,g,8p,g,g,8p,g,g,8p,g,p,g,f,p,d#,8p,d#,d#,8p,d#,d#,8p,d#,p,d#,f,p,g,8p,g,g,8p,g,g,8p,g,p,g,f,p,d#,8p,d#,d#,8p,d#,d#,8p,d#,p,d#,f,p

WannaBeS:d=16,o=6,b=112:d,d,d,d,d,e,p,e,p,e,p,8f#.,8d.,d,8d,d,e,p,e,p,e,p,8d.,8b5,d,d,d,d,d,e,p,e,p,e,p,8f#.,8d.,d,8d,d,e,p,8f#,a,p,8g#.,8e.

WhiteWed:d=8,o=5,b=63:32p,c,16d#,16f,g,16g,c,d#,f,4f.,c,16d#,16f,g,16g,a#,g,f,16g,4g.,c,16d#,16f,g,16g,a#,g,f,16g,g,c,16d#,16f,g,16g,a#,g,f,16g,c,c,16d#,16f,g,16g,a#,4g,16d#,c,d#,d#,c.,a#,16g,16f,4g.,16d#,4c,d#,d#,16c,4c,d#,16d#,2d#

Wipeout:d=8,o=6,b=180:g5,a#5,b5,c,c,c,a#5,g5,g5,a#5,b5,c,c,c,a#5,g5,c,d#,e,f,f,f,d#,c,c,d#,e,f,f,f,d#,c,g5,a#5,b5,c,c,c,a#5,g5,g5,a#5,b5,c,c,c,a#5,g5,c,e,f,g,g,g,f,d,d,g,g,f,f,f,d#,c,g5,a#5,b5,c,c,c,a#5,g5,g5,c,a#5,g5,g5,g5,4g5

Ymca:d=4,o=5,b=160:16f#6,2d#6,16d#6,16c#6,16b,16c#6,16d#6,8f#6,16d#6,8f#6,16g#6,2d#6,16d#6,16c#6,16b,16c#6,16d#6,8f#6,16d#6,8f#6,16g#6,2e6,16e6,16d#6,16c#6,16d#6,16e6,8g#6,16b6,8g#6,a#6,g#6,f#6,e6,8d#6,8c#6

Transmitter

Ringtones

Python Programming

Micropython