

Pico Project Week Two

Adding sound to Pico Face

This week we are adding sound to the Pico Face that we made last. To make things a little more interesting we are going to construct our own loudspeaker from commonly available components.

Components

To make our loudspeaker we are going to need the following.

- Small dc motor
- Disposable plastic cup
- Milk carton cap
- Neodymium magnet 1cm x 0.5cm
- Hookup wire
- Paper



Tools

We will also need the following tools

- Thin-nose pliers
- Snips
- Scissors
- Scalpel or craft knife
- Masking tape
- AAA battery
- Super glue
- Hot glue gun (Can use epoxy but glue gun is much easier)
- Soldering iron
- Pen



Step one

Cut a rectangular piece of paper and attach it to the AAA battery using masking tape. (Make sure the cylinder you make can still freely move on the battery)



Step two

Using the long nose plier disassemble the dc motor, we are interested in the enamelled copper wire that is wound onto the motor.



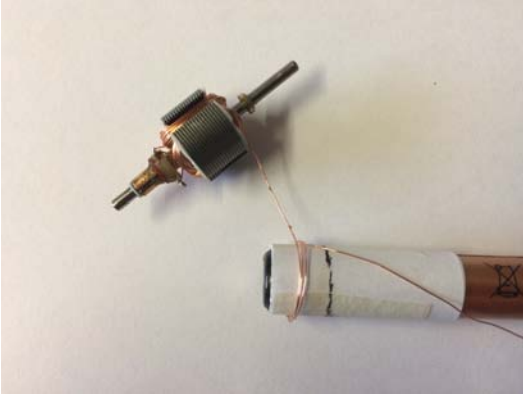
Step three

Stand the battery, paper cylinder side down, in the milk carton cap and using a pen mark the cylinder where it meets the top of the cap.



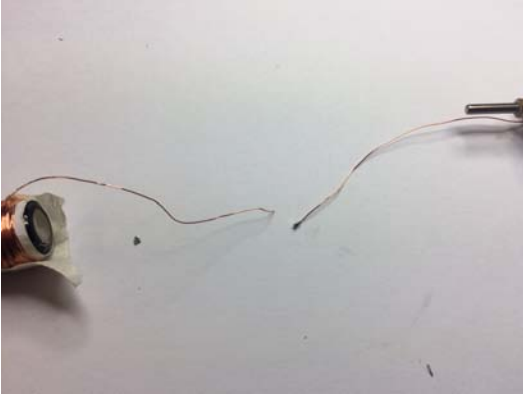
Step four

In the dc motor there are three windings, we are going to use two of them in our loudspeaker to make a coil. Start by snipping the end of one of the windings and wind it onto the AAA battery, when you get to the end of the winding hold it in place with a piece of tape. (Try to lay the windings next to each other if possible) You should get roughly 50 turns.



Step five

We now need to add another winding to our coil to bring the turns up to around 50. Start by snipping the end of the next winding. We need to solder the end of our first coil to the start of our second. The wire is covered in a thin layer of enamel which needs to be removed to make a good soldered joint. You can use a scalpel or knife to scrape away the enamel. Once both are clean solder them together.



Step six

Continue winding the coil with the second winding, at the end hold the coil in place with a few drops of super glue and some masking tape. Cut the completed coil off using a craft knife.



Step seven

That's the coil completed we now need to glue it to the centre of the milk carton cap. You can use epoxy glue but I found it much easier and quicker to use a hot glue gun. First make a hole in the cap to pass the copper coil wires through then glue the coil to the cap. Use some glue to hold the wires in place.



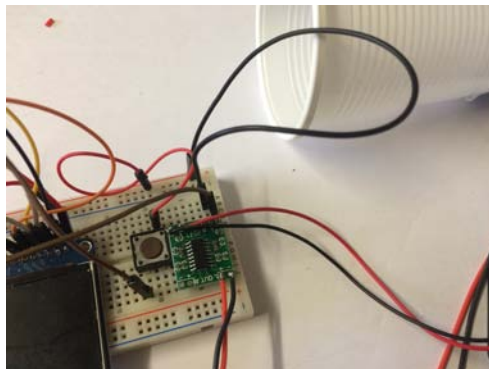
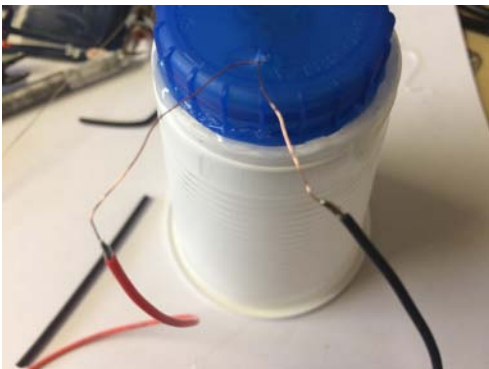
Step eight

Put some glue on the top of the disposable cup and attach the magnet, try to make sure that glue doesn't ride up the side of the magnet. When the glue has set. Put the coil with the cap on top of the magnet and glue all into place.



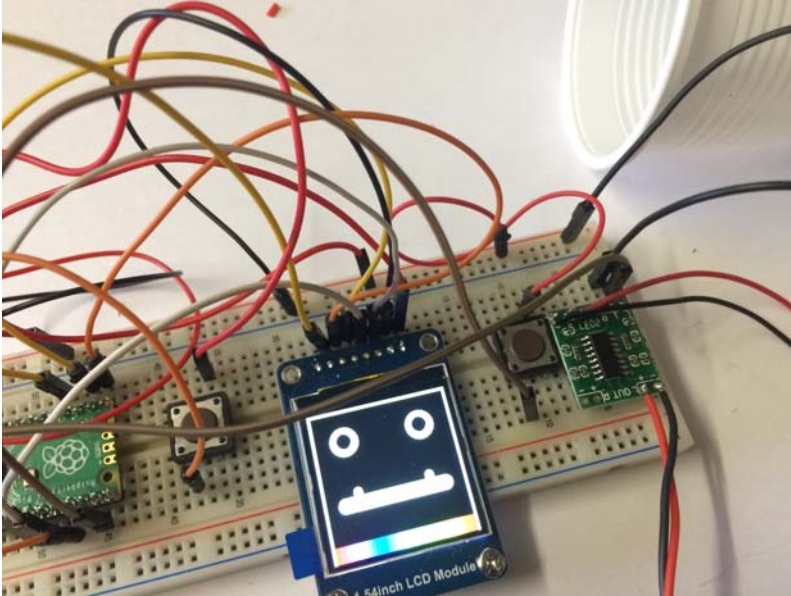
Step nine

We now need to solder two hookup wires to the enamelled copper wires, again you will need to make sure that the enamel is scraped off the end of each wire. Solder a hookup wire to each copper wire, cover in heat shrink and then solder to the amplifier connected to the Pico. If using a stereo amplifier, connect to the left channel. Polarity for our single speaker system doesn't matter.



Step 10

This is the completed project.



Software

The software listing is given below. Pressing the left or right button produces a sound. Note the sound is produced by GP0. Depending on your amplifier you may or may not need an additional power supply.

```
import board
import terminalio
import busio
import displayio
from adafruit_display_text import label
from adafruit_display_shapes import circle
from adafruit_st7789 import ST7789
import adafruit_imageload
import digitalio
import time, random

import audiomp3
import audiopwmio

audio = audiopwmio.PWMAudioOut(board.GP0, quiescent_value=32768)

mp3files = ["A.mp3", "B.mp3"]
mp3 = open(mp3files[0], "rb")

# Release any resources currently in use for the displays
displayio.release_displays()
# SPI pins for display st7789
tft_cs = board.GP17
tft_dc = board.GP16
# setup spi bus
spi = busio.SPI(board.GP10, board.GP11)
```

```

# setup display
display_bus = displayio.FourWire(spi, command=tft_dc,
                                chip_select=tft_cs, reset=board.GP18)
display = ST7789(display_bus,
                width=240,
                height=240,
                rowstart=80,
                auto_refresh=True)
# Make the display context
screen = displayio.Group()
r_eye_g = displayio.Group()

display.show(screen)

bgIm, bgPal = adafruit_imageload.load('/ims/bg.bmp',
                                     bitmap=displayio.Bitmap,
                                     palette=displayio.Palette
                                     )
bg = displayio.TileGrid(bgIm,
                       pixel_shader=bgPal,
                       width=1,
                       height=1,
                       tile_width=240,
                       tile_height=240,
                       default_tile=0)

eyelm, eyePal = adafruit_imageload.load('/ims/eye.bmp',
                                       bitmap=displayio.Bitmap,
                                       palette=displayio.Palette
                                       )
r_eye = displayio.TileGrid(eyelm,
                          pixel_shader=eyePal,
                          width=1,
                          height=1,
                          tile_width=48,
                          tile_height=48,
                          default_tile=0)
l_eye = displayio.TileGrid(eyelm,
                          pixel_shader=eyePal,
                          width=1,
                          height=1,
                          tile_width=48,
                          tile_height=48,
                          default_tile=0)
mouthIm, mouthPal = adafruit_imageload.load('/ims/mouth.bmp',
                                             bitmap=displayio.Bitmap,
                                             palette=displayio.Palette
                                             )
mouth = displayio.TileGrid(mouthIm,
                          pixel_shader=eyePal,
                          width=1,
                          height=1,
                          tile_width=192,
                          tile_height=72,
                          default_tile=0)
r_eye.x, r_eye.y = 30, 30
l_eye.x, l_eye.y = 160, 30
mouth.x, mouth.y = 24, 120
screen.append(bg)
screen.append(r_eye)

```

```
screen.append(l_eye)
screen.append(mouth)

buttonOne = digitalio.DigitalInOut(board.GP13)
buttonOne.switch_to_input(pull=digitalio.Pull.DOWN)
buttonTwo = digitalio.DigitalInOut(board.GP14)
buttonTwo.switch_to_input(pull=digitalio.Pull.DOWN)

r_pupil = circle.Circle(53, 52, 12, fill=0x000000)
l_pupil = circle.Circle(183, 52, 12, fill=0x000000)
screen.append(r_pupil)
screen.append(l_pupil)
```

```
while True:
```

```
    if buttonOne.value:
        r_eye[0] = 1
        mp3 = open(mp3files[0], "rb")
        decoder = audiomp3.MP3Decoder(mp3)
        decoder.file = open("A.mp3", "rb")
        audio.play(decoder)
    else:
        r_eye[0] = 0
```

```
    if buttonTwo.value:
        l_eye[0] = 1
        mp3 = open(mp3files[1], "rb")
        decoder = audiomp3.MP3Decoder(mp3)
        decoder.file = open("B.mp3", "rb")
        audio.play(decoder)
    else:
        l_eye[0] = 0
```

```
    if buttonTwo.value and buttonOne.value:
        mouth[0] = random.choice([1,2,3])
        time.sleep(0.2)
    else:
        mouth[0] = 0
    x = random.randint(0, 200)
```

```
    if x == 1:
        r_eye[0] = 1
        l_eye[0] = 1
        time.sleep(0.2)
```

```
    while audio.playing:
        pass
```