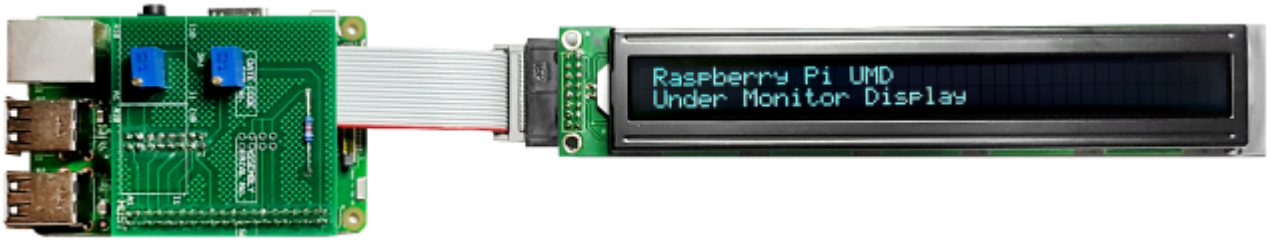
The Python Code



The Code Running the LCD

By now you should have your Raspberry Pi and LCD running. Here we will discuss the Python code that runs the LCD display and how it works (at a top level).

The Code

On each Raspberry Pi there is a file called UMDisplay0x.py. This is the file that sends data to the LCD, it is the same on each Pi except for a setting that tells the Pi which 2 of the 8 text lines to use.

(This is from the Master Pi)

The File Header

This is to identify to the Linux system what this file type is, and to allow the author to add some information (anything following a hash # is just a comment)

```
#!/usr/bin/python
#--------------------------------------
#  16x2 LCD Test Script
#
# Author : Alan Walker
# Date   : 16/05/2016
#--------------------------------------
```

```
# The wiring for the LCD is as follows:
# 1 : GND
# 2 : 5V
# 3 : Contrast (0-5V)*          -   Sets the LCD Contrast
# 4 : RS (Register Select)      -   GPIO pin 26 - Physical pin 37
# 5 : R/W (Read Write)          -   GROUND THIS PIN
# 6 : Enable or Strobe          -   GPIO pin 19 - Physical pin 35
# 7 : Data Bit 0             - NOT USED
# 8 : Data Bit 1             - NOT USED
# 9 : Data Bit 2             - NOT USED
# 10: Data Bit 3             - NOT USED
# 11: Data Bit 4                -   GPIO pin 13 - Physical pin 33
# 12: Data Bit 5                -   GPIO pin 06 - Physical pin 31
# 13: Data Bit 6                -   GPIO pin 05 - Physical pin 29
# 14: Data Bit 7                -   GPIO pin 11 - Physical pin 23
# 15: LCD Backlight             -   +5V**
# 16: LCD Backlight             -   GND

#import
import RPi.GPIO as GPIO
import time
import socket
import fcntl
import struct
```

```
# Define GPIO to LCD mapping
LCD_RS = 26
LCD_E  = 19
LCD_D4 = 13
LCD_D5 = 6
LCD_D6 = 5
LCD_D7 = 11


# Define some device constants
LCD_WIDTH = 40    # Maximum characters per line
LCD_CHR = True
LCD_CMD = False

# Do I need to change line 2 address for 40 char display?
LCD_LINE_1 = 0x80 # LCD RAM address for the 1st line
LCD_LINE_2 = 0xC0 # LCD RAM address for the 2nd line

# Timing constants
E_PULSE = 0.0005
E_DELAY = 0.0005

def main():
  # Main program block

  GPIO.setwarnings(False)
  GPIO.setmode(GPIO.BCM)       # Use BCM GPIO numbers
  GPIO.setup(LCD_E, GPIO.OUT)  # E
  GPIO.setup(LCD_RS, GPIO.OUT) # RS
  GPIO.setup(LCD_D4, GPIO.OUT) # DB4
  GPIO.setup(LCD_D5, GPIO.OUT) # DB5
  GPIO.setup(LCD_D6, GPIO.OUT) # DB6
  GPIO.setup(LCD_D7, GPIO.OUT) # DB7

#########################################
#             PROGRAM  START             #
#########################################


  # Initialise display
  lcd_init()

  lcd_string(" Waiting 5 Seconds for Network Start",LCD_LINE_1) # wait 5 seconds for DHCP process to
finish
  time.sleep(5)


  while True:
    ## Open the file with read only permit
    f = open('/home/pi/Python/my_data.txt', "r")

    ## use readlines to read all the lines in the file
    ## The variable "lines" is a list containing all lines
    # readline 400 is read in 400 chars
    # replace removed the carriage return and new line
    # [:40] truncates to 40 chars

    line1 = f.readline(400).replace("\r\n","")[:40]
    line2 = f.readline(400).replace("\r\n","")[:40]
    line3 = f.readline(400).replace("\r\n","")[:40]
    line4 = f.readline(400).replace("\r\n","")[:40]
    line5 = f.readline(400).replace("\r\n","")[:40]
    line6 = f.readline(400).replace("\r\n","")[:40]
    line7 = f.readline(400).replace("\r\n","")[:40]
    line8 = f.readline(400).replace("\r\n","")[:40]

    ## close the file after reading the lines.
    f.close()

#    Display the current IP Address information
```

```
#    lcd_string("  lo" + " " + get_ip_address('lo'),LCD_LINE_1)
#    lcd_string("  UMD 04",LCD_LINE_1)
#    lcd_string(" eth0" + " " + get_ip_address('eth0'),LCD_LINE_2)

#    time.sleep(2) # x second delay

    # write line 1 and 2 to the LCD (Line7 and Line8 because this is UMD4)
    lcd_string(" " + line1,LCD_LINE_1)
    lcd_string(" " + line2,LCD_LINE_2)

    time.sleep(1) # x second delay


########################################
#     CHANGE NO CODE BELOW THIS LINE     #
########################################


def get_ip_address(ifname):
    s = socket.socket(socket.AF_INET, socket.SOCK_DGRAM)
    return socket.inet_ntoa(fcntl.ioctl(
        s.fileno(),
        0x8915,  # SIOCGIFADDR
        struct.pack('256s', ifname[:15])
    )[20:24])


def lcd_init():
  # Initialise display
  lcd_byte(0x33,LCD_CMD) # 110011 Initialise
  lcd_byte(0x32,LCD_CMD) # 110010 Initialise
  lcd_byte(0x06,LCD_CMD) # 000110 Cursor move direction
  lcd_byte(0x0C,LCD_CMD) # 001100 Display On,Cursor Off, Blink Off
  lcd_byte(0x28,LCD_CMD) # 101000 Data length, number of lines, font size
  lcd_byte(0x01,LCD_CMD) # 000001 Clear display
  time.sleep(E_DELAY)

def lcd_byte(bits, mode):
  # Send byte to data pins
  # bits = data
  # mode = True  for character
  #        False for command

  GPIO.output(LCD_RS, mode) # RS

  # High bits
  GPIO.output(LCD_D4, False)
  GPIO.output(LCD_D5, False)
  GPIO.output(LCD_D6, False)
  GPIO.output(LCD_D7, False)
  if bits&0x10==0x10:
    GPIO.output(LCD_D4, True)
  if bits&0x20==0x20:
    GPIO.output(LCD_D5, True)
  if bits&0x40==0x40:
    GPIO.output(LCD_D6, True)
  if bits&0x80==0x80:
    GPIO.output(LCD_D7, True)

  # Toggle 'Enable' pin
  lcd_toggle_enable()

  # Low bits
  GPIO.output(LCD_D4, False)
  GPIO.output(LCD_D5, False)
  GPIO.output(LCD_D6, False)
  GPIO.output(LCD_D7, False)
  if bits&0x01==0x01:
    GPIO.output(LCD_D4, True)
  if bits&0x02==0x02:
```

```
    GPIO.output(LCD_D5, True)
  if bits&0x04==0x04:
    GPIO.output(LCD_D6, True)
  if bits&0x08==0x08:
    GPIO.output(LCD_D7, True)

  # Toggle 'Enable' pin
  lcd_toggle_enable()

def lcd_toggle_enable():
  # Toggle enable
  time.sleep(E_DELAY)
  GPIO.output(LCD_E, True)
  time.sleep(E_PULSE)
  GPIO.output(LCD_E, False)
  time.sleep(E_DELAY)

def lcd_string(message,line):
  # Send string to display

  message = message.ljust(LCD_WIDTH," ")

  lcd_byte(line, LCD_CMD)

  for i in range(LCD_WIDTH):
    lcd_byte(ord(message[i]),LCD_CHR)

if __name__ == '__main__':

  try:
    main()
  except KeyboardInterrupt:
    pass
  finally:
    #lcd_byte(0x01, LCD_CMD)
    #lcd_string("Goodbye!",LCD_LINE_1)
    GPIO.cleanup()
```

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# 15: LCD Backlight             -   +5V**
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  GPIO.setup(LCD_D6, GPIO.OUT) # DB6
  GPIO.setup(LCD_D7, GPIO.OUT) # DB7

##########################################
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    line6 = f.readline(400).replace("\r\n","")[:40]
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    line8 = f.readline(400).replace("\r\n","")[:40]

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    f.close()

#    Display the current IP Address information
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#    lcd_string(" eth0" + " " + get_ip_address('eth0'),LCD_LINE_2)

#    time.sleep(2) # x second delay

    # write line 1 and 2 to the LCD (Line7 and Line8 because this is UMD4)
    lcd_string(" " + line1,LCD_LINE_1)
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  if bits&0x10==0x10:
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  if bits&0x20==0x20:
    GPIO.output(LCD_D5, True)
```

```
  if bits&0x40==0x40:
    GPIO.output(LCD_D6, True)
  if bits&0x80==0x80:
    GPIO.output(LCD_D7, True)

  # Toggle 'Enable' pin
  lcd_toggle_enable()

  # Low bits
  GPIO.output(LCD_D4, False)
  GPIO.output(LCD_D5, False)
  GPIO.output(LCD_D6, False)
  GPIO.output(LCD_D7, False)
  if bits&0x01==0x01:
    GPIO.output(LCD_D4, True)
  if bits&0x02==0x02:
    GPIO.output(LCD_D5, True)
  if bits&0x04==0x04:
    GPIO.output(LCD_D6, True)
  if bits&0x08==0x08:
    GPIO.output(LCD_D7, True)

  # Toggle 'Enable' pin
  lcd_toggle_enable()

def lcd_toggle_enable():
  # Toggle enable
  time.sleep(E_DELAY)
  GPIO.output(LCD_E, True)
  time.sleep(E_PULSE)
  GPIO.output(LCD_E, False)
  time.sleep(E_DELAY)

def lcd_string(message,line):
  # Send string to display

  message = message.ljust(LCD_WIDTH," ")

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  try:
    main()
  except KeyboardInterrupt:
    pass
  finally:
    #lcd_byte(0x01, LCD_CMD)
    #lcd_string("Goodbye!",LCD_LINE_1)
    GPIO.cleanup()
```