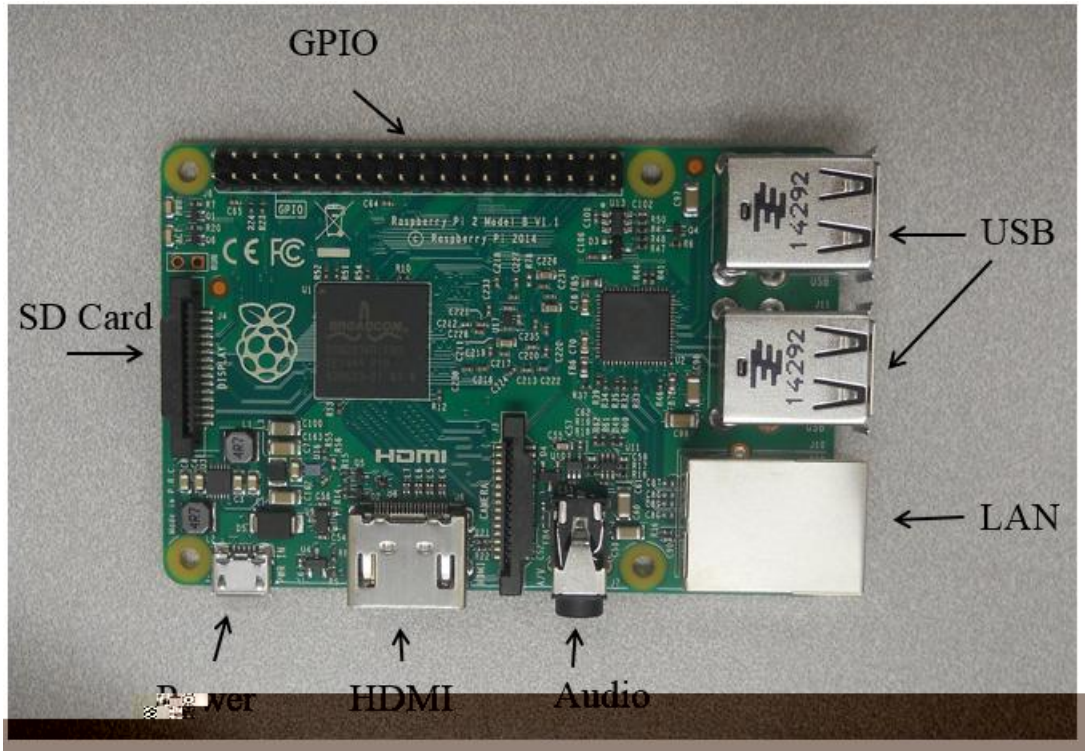
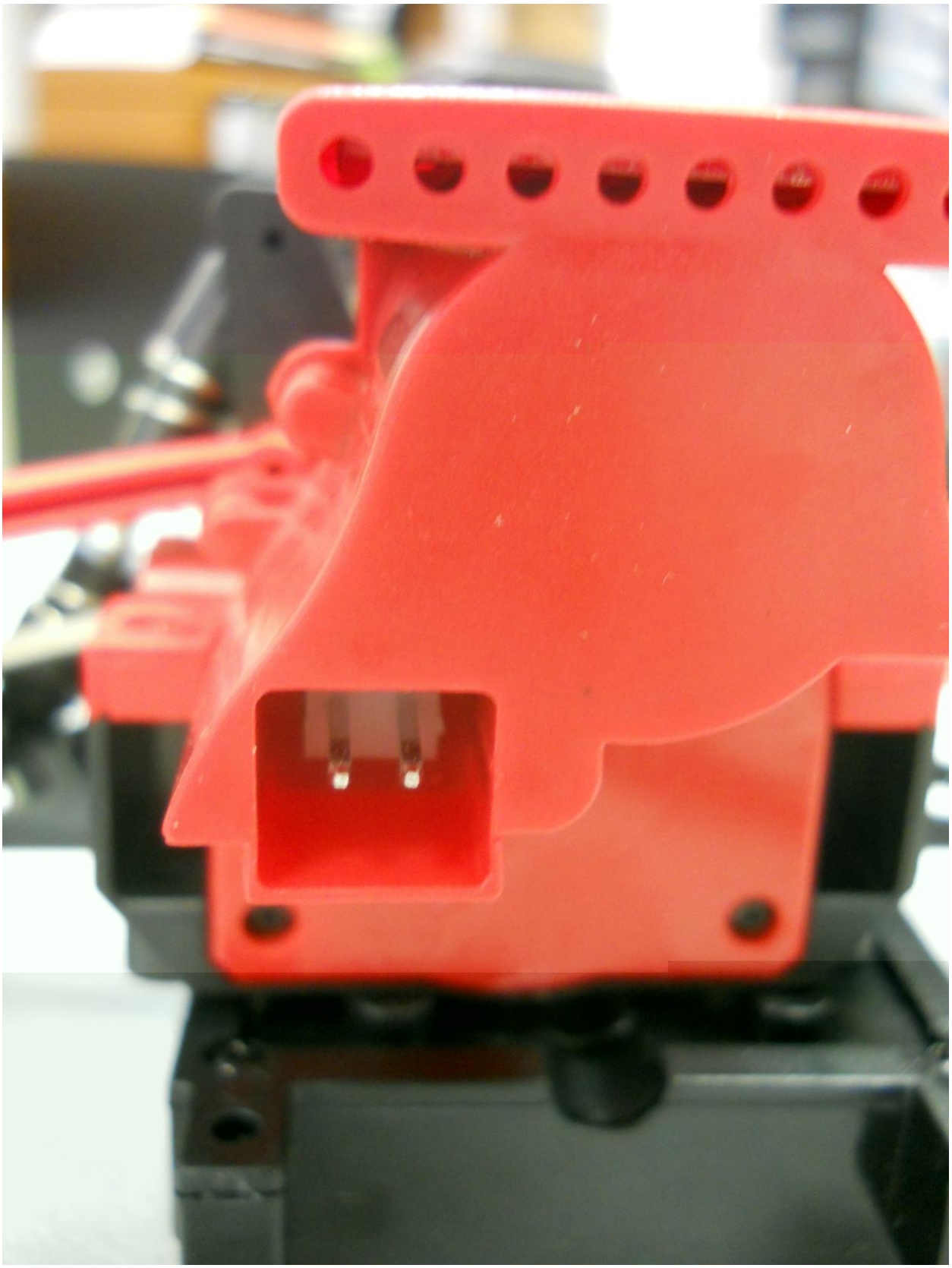
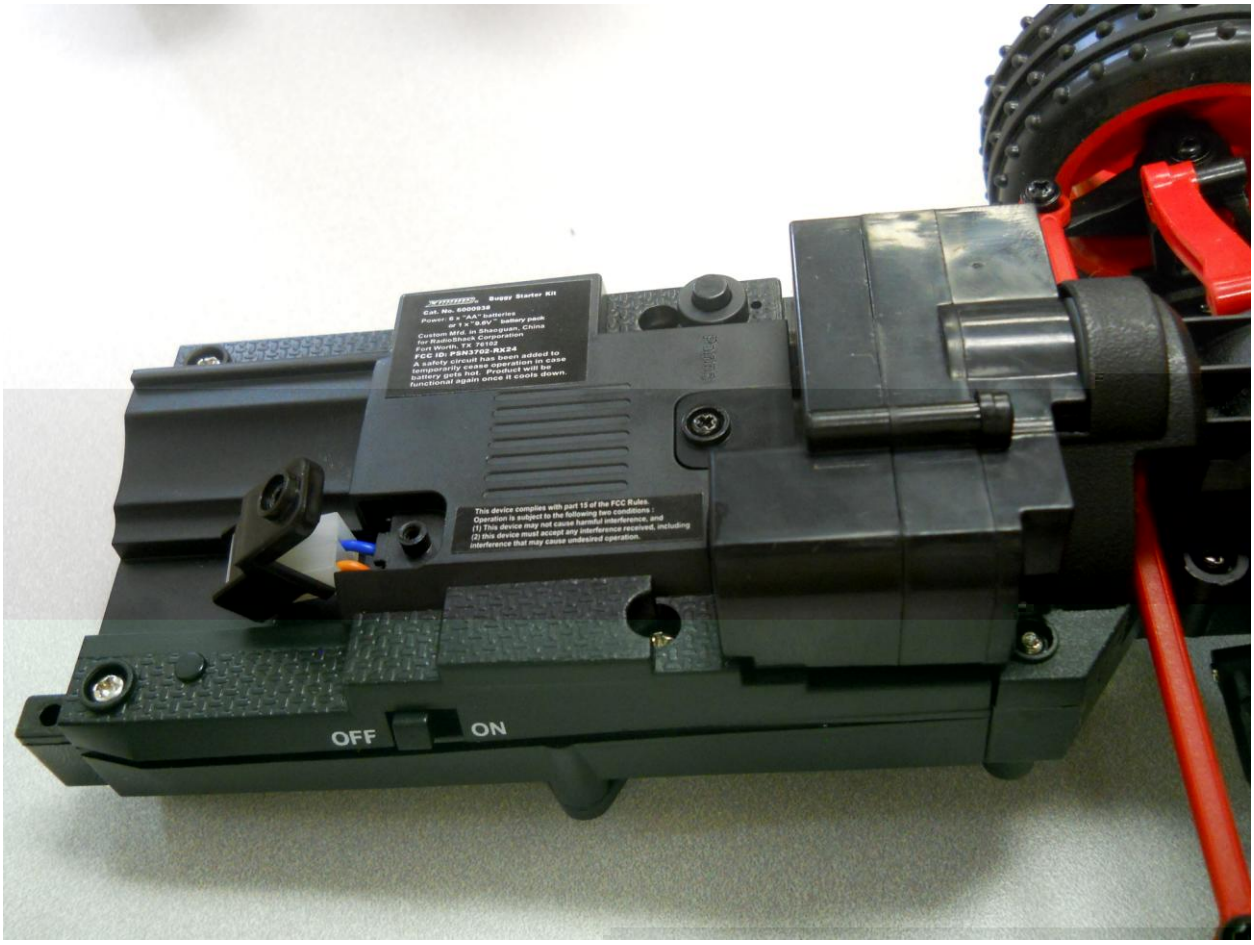
Chapter 1: Adding Raspberry Pi to an RC Vehicle

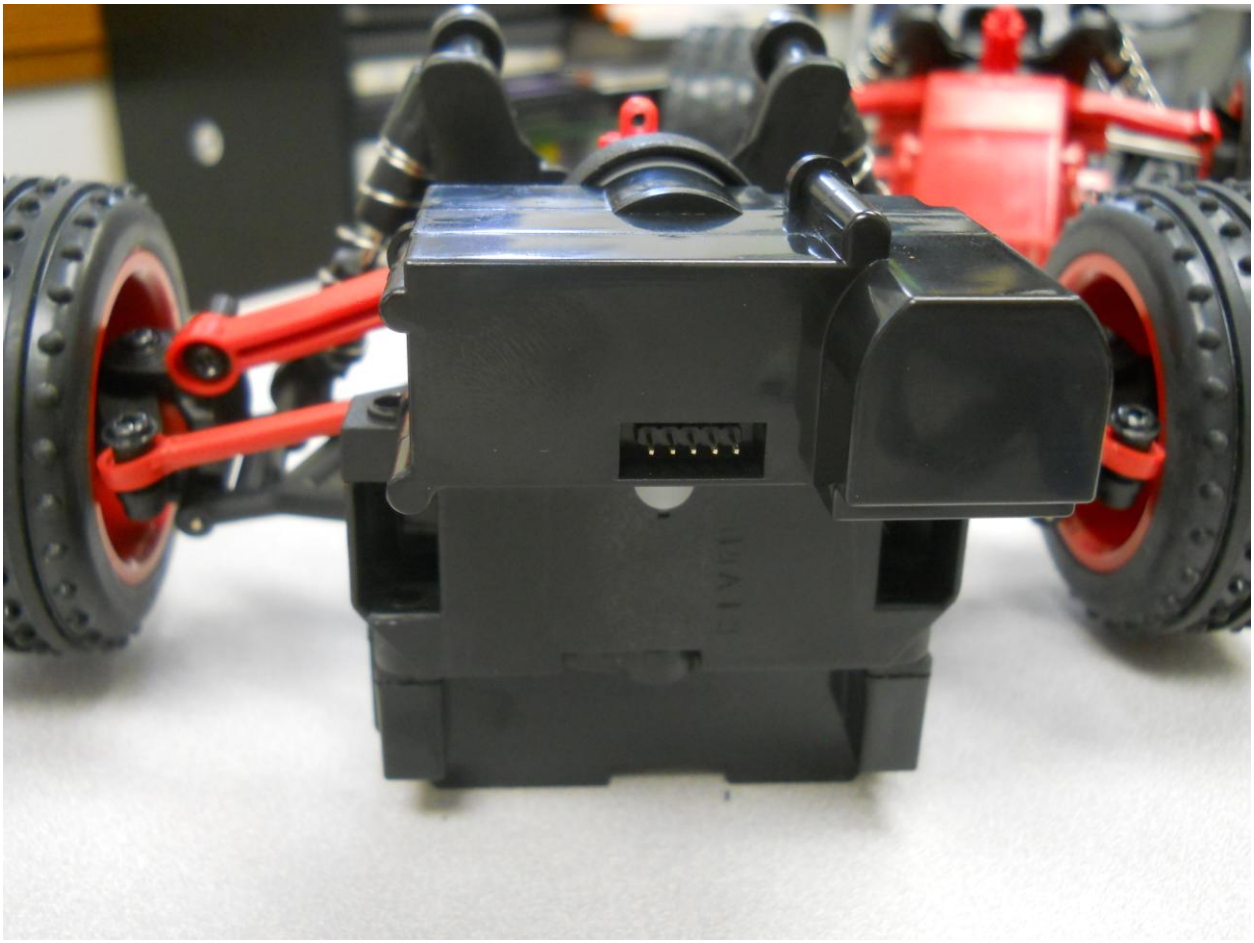



xmods

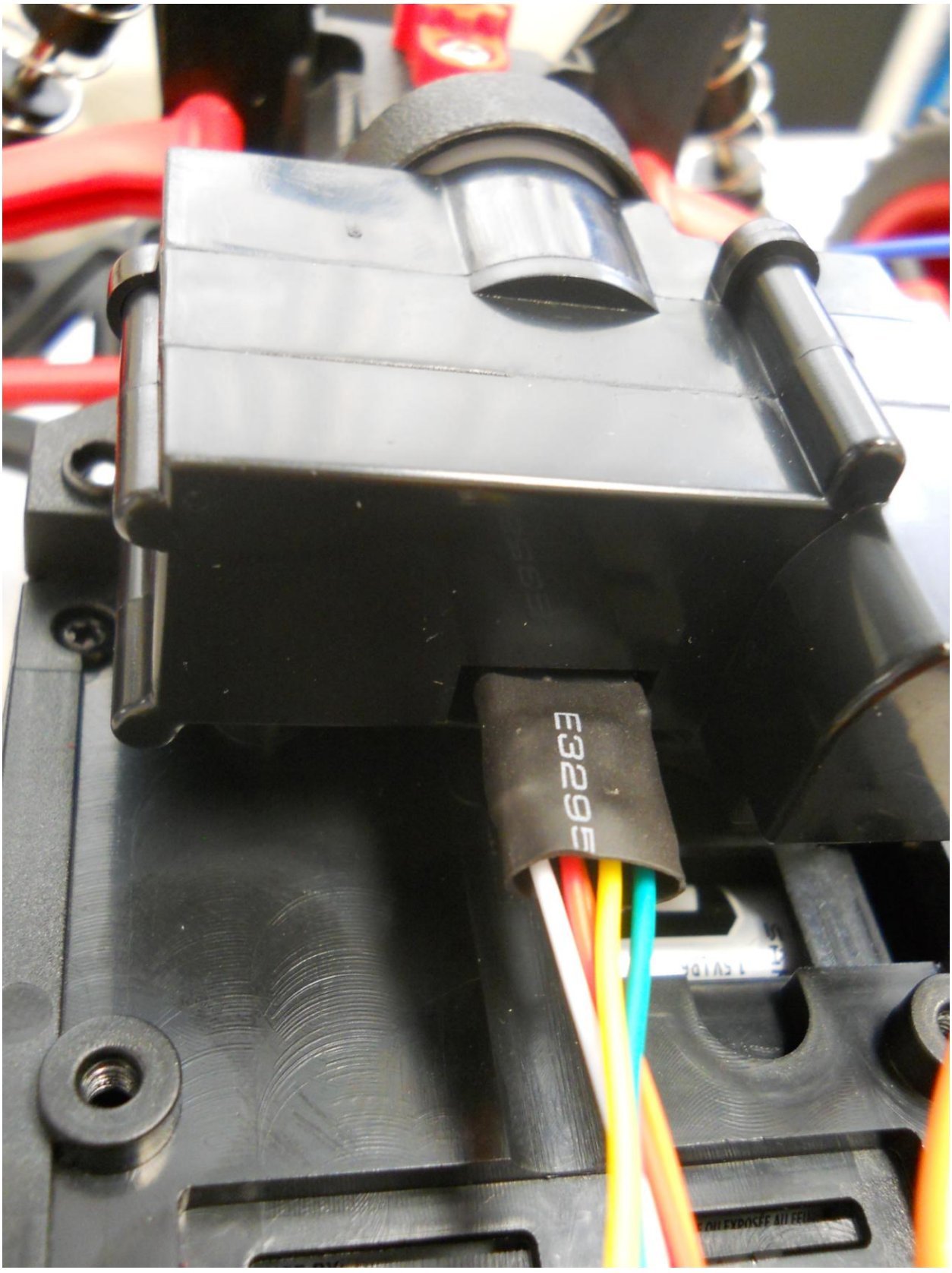

OFF
ON

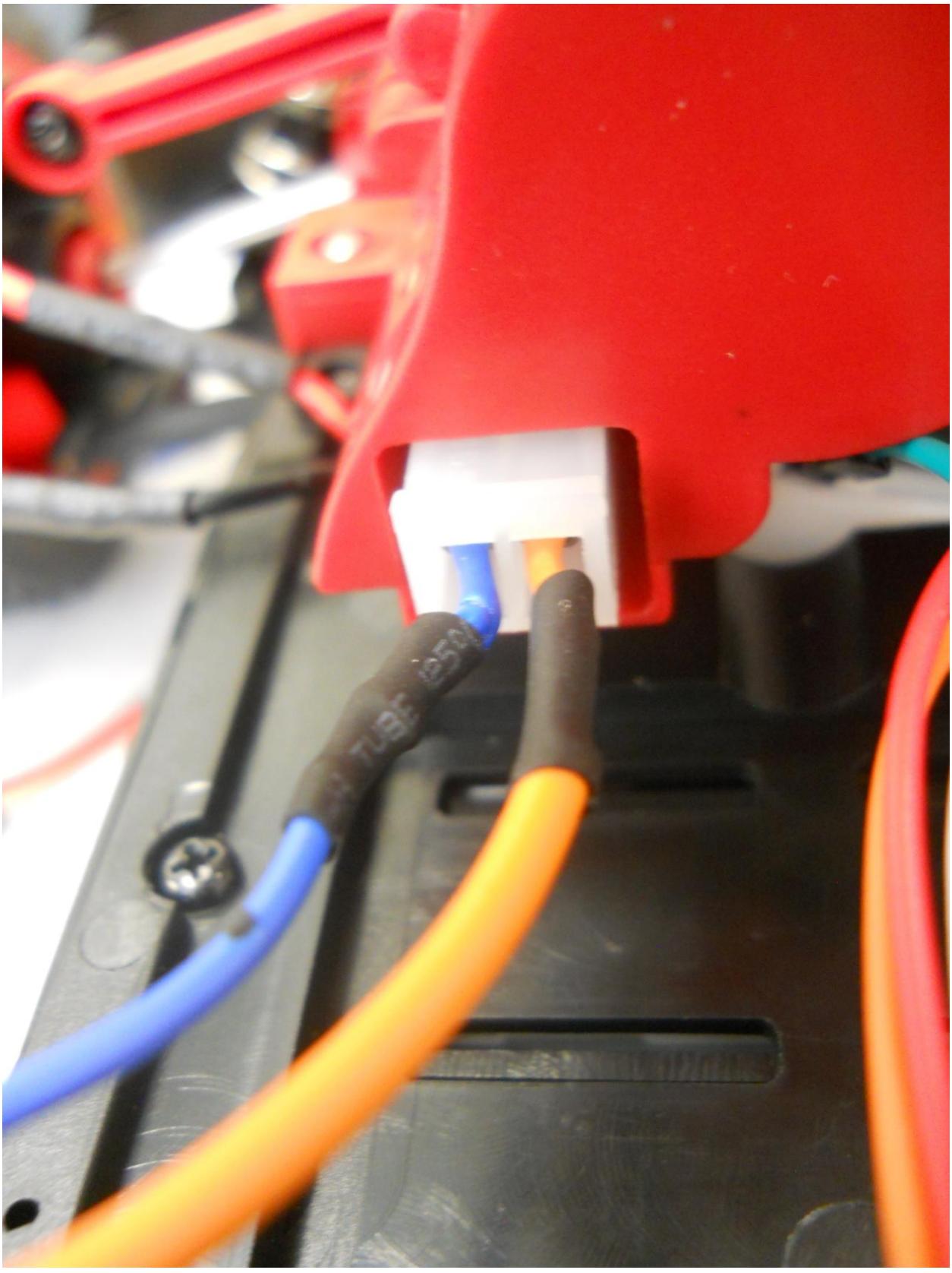


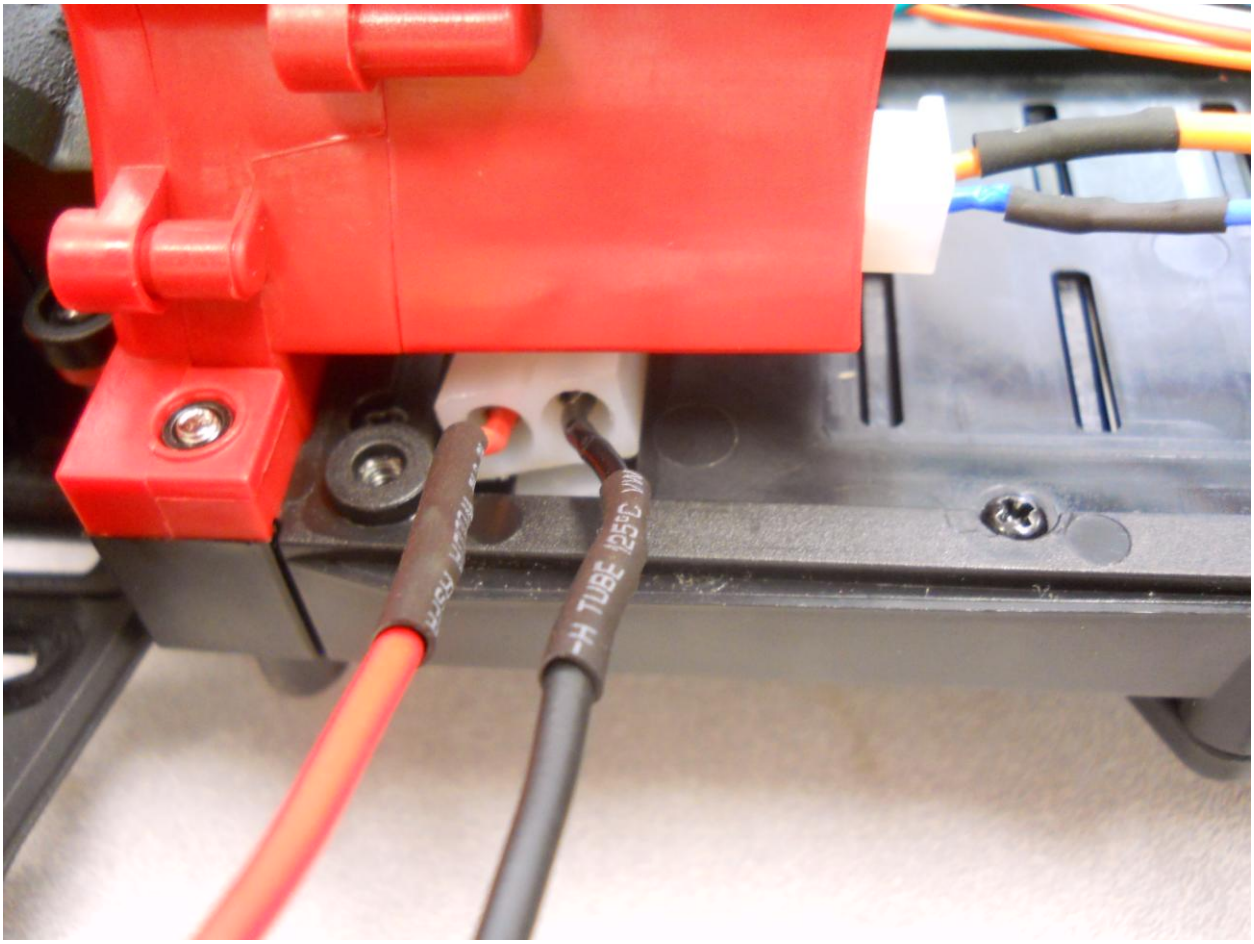

Buggy Starter Kit
Cat. No. 6000528
Power: 6 x "AA" batteries
or 1 x "9.6V" battery pack
Custom Mfd. in Changuan, China
for RadioShack Corporation
Fort Worth, TX 76102
FCC ID: PSN3702-RX24
A safety circuit has been added to
temporarily cease operation in case
battery gets hot. Product will be
functional again once it cools down.
This device complies with part 15 of the FCC Rules.
Operation is subject to the following two conditions :
(1) This device may not cause harmful interference, and
(2) this device must accept any interference received, including
interference that may cause undesired operation.
OFF
ON

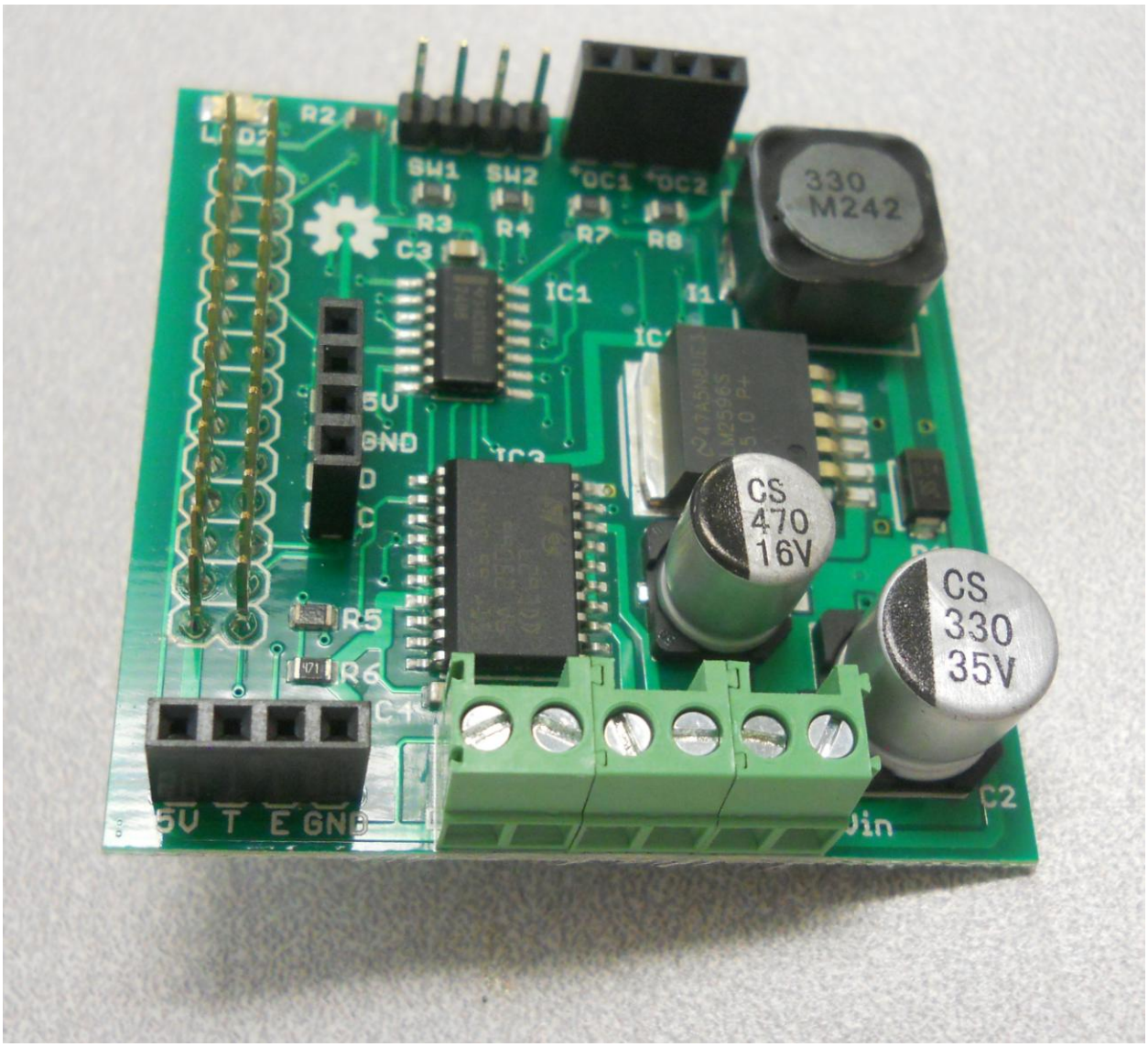


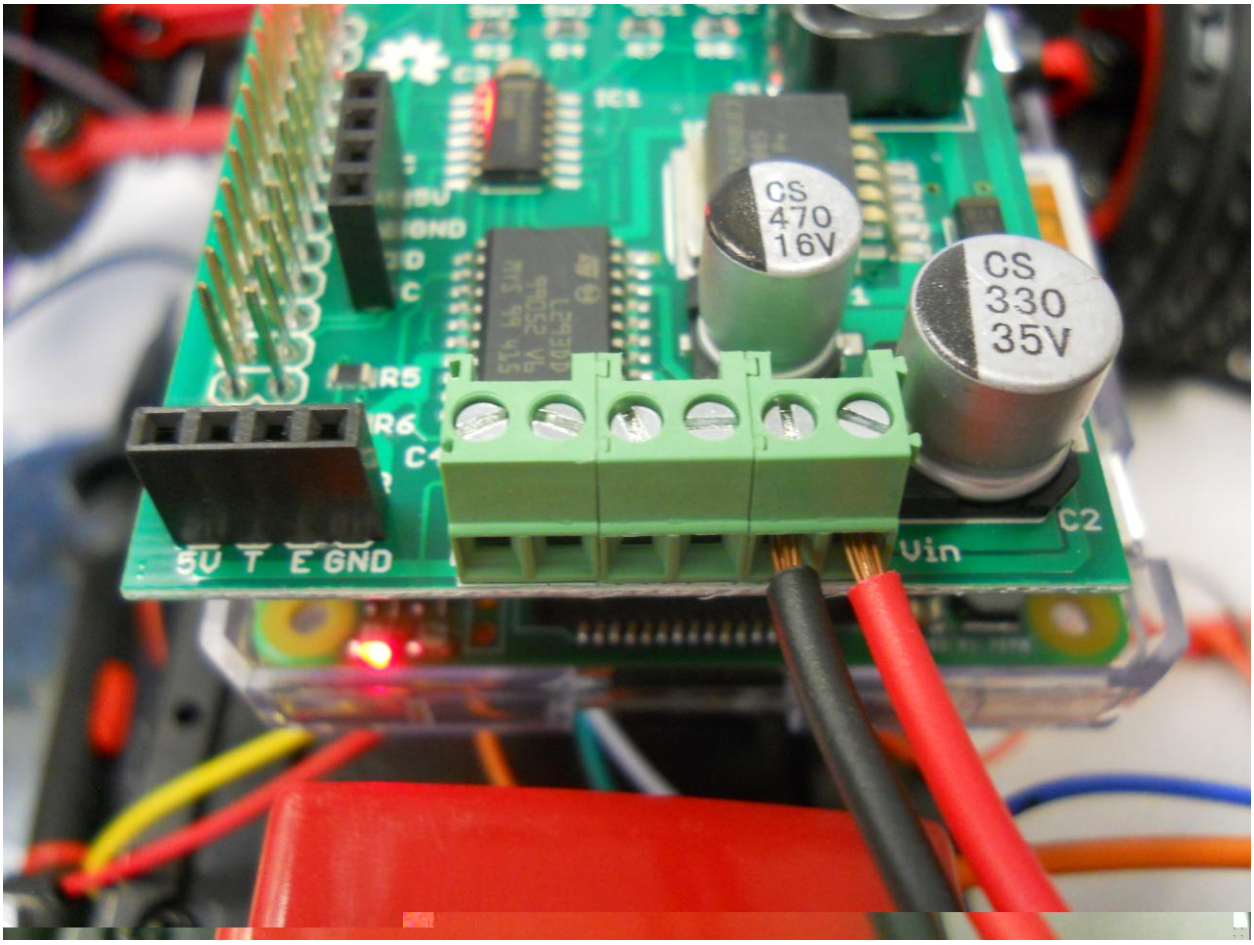

Pairing

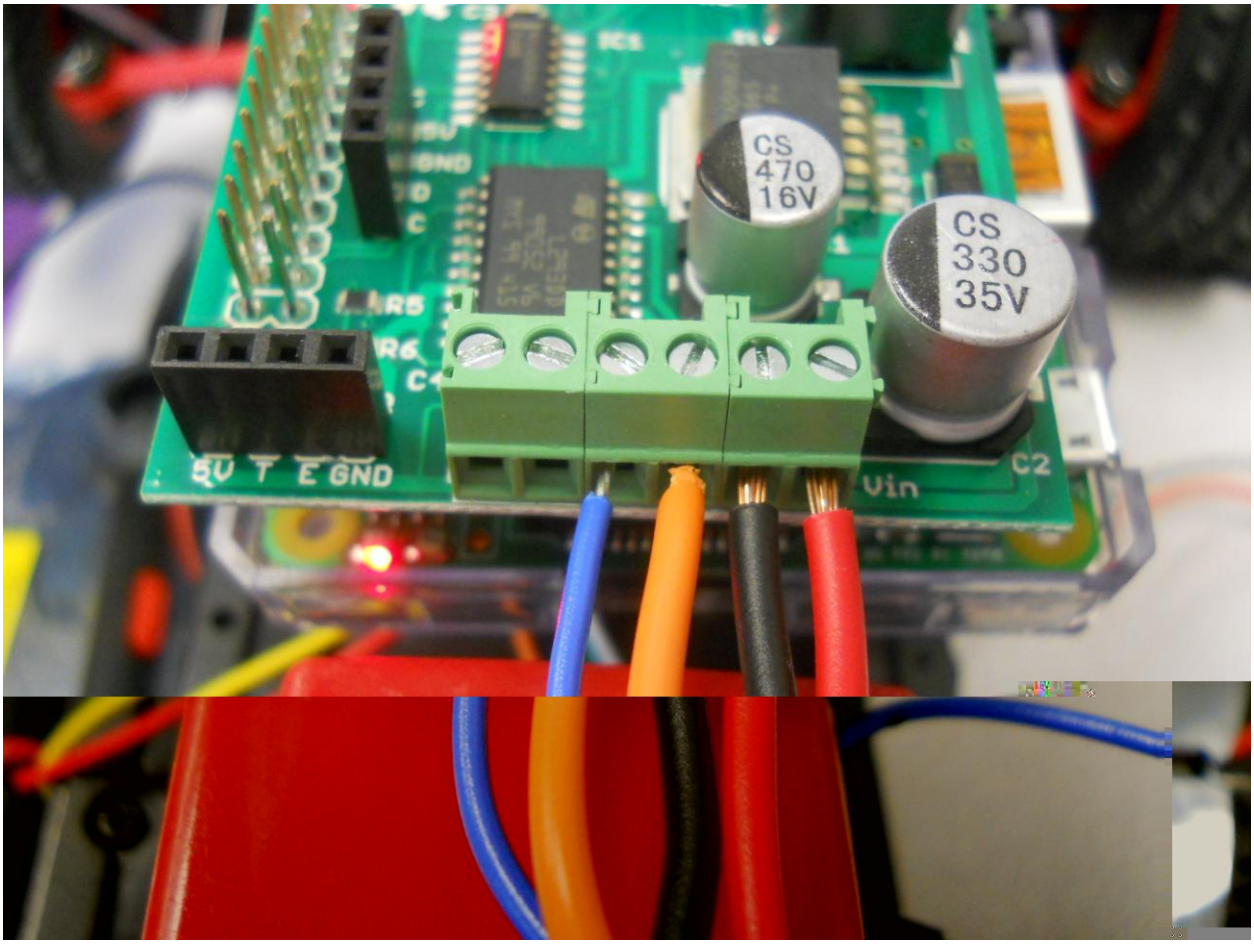

E3295

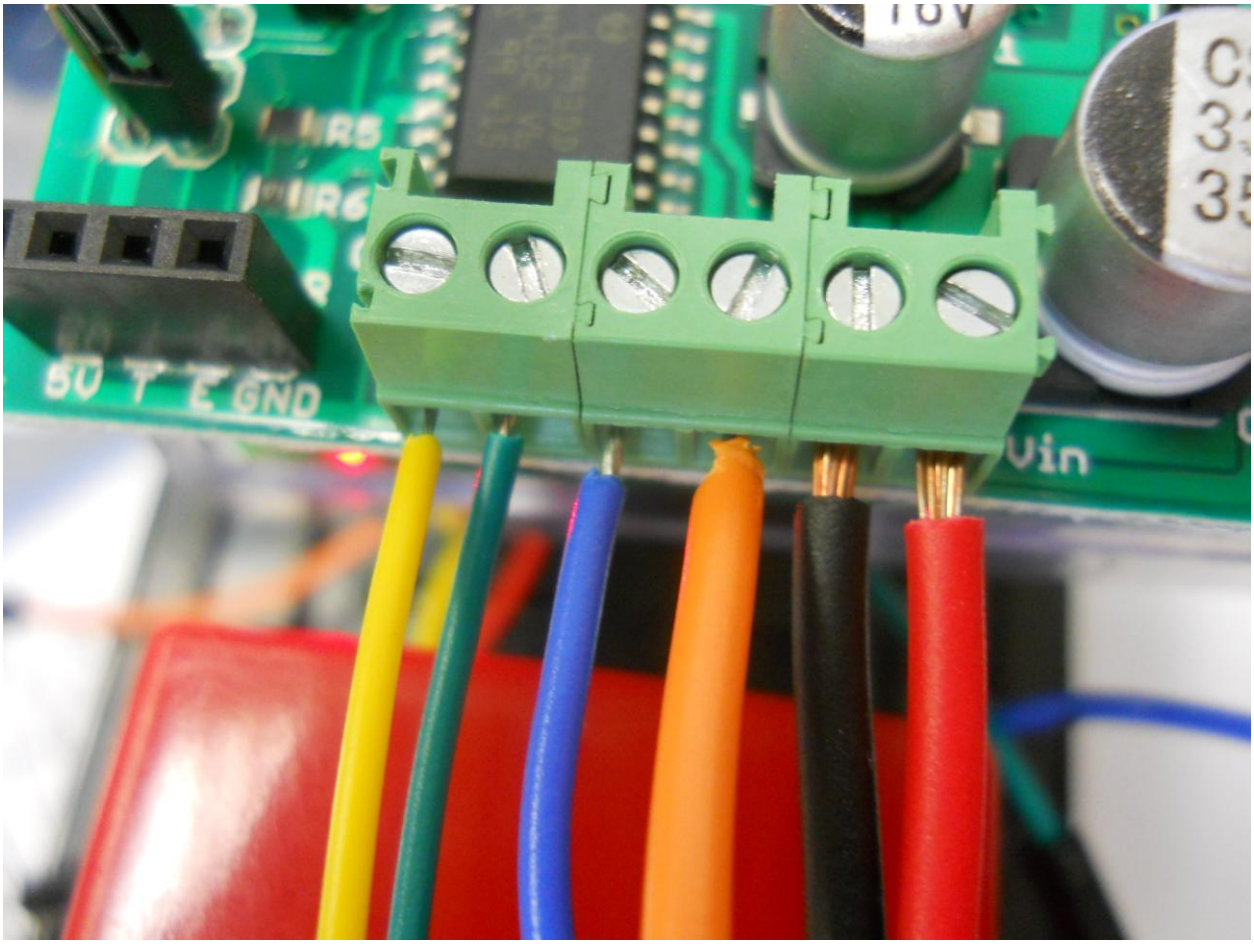


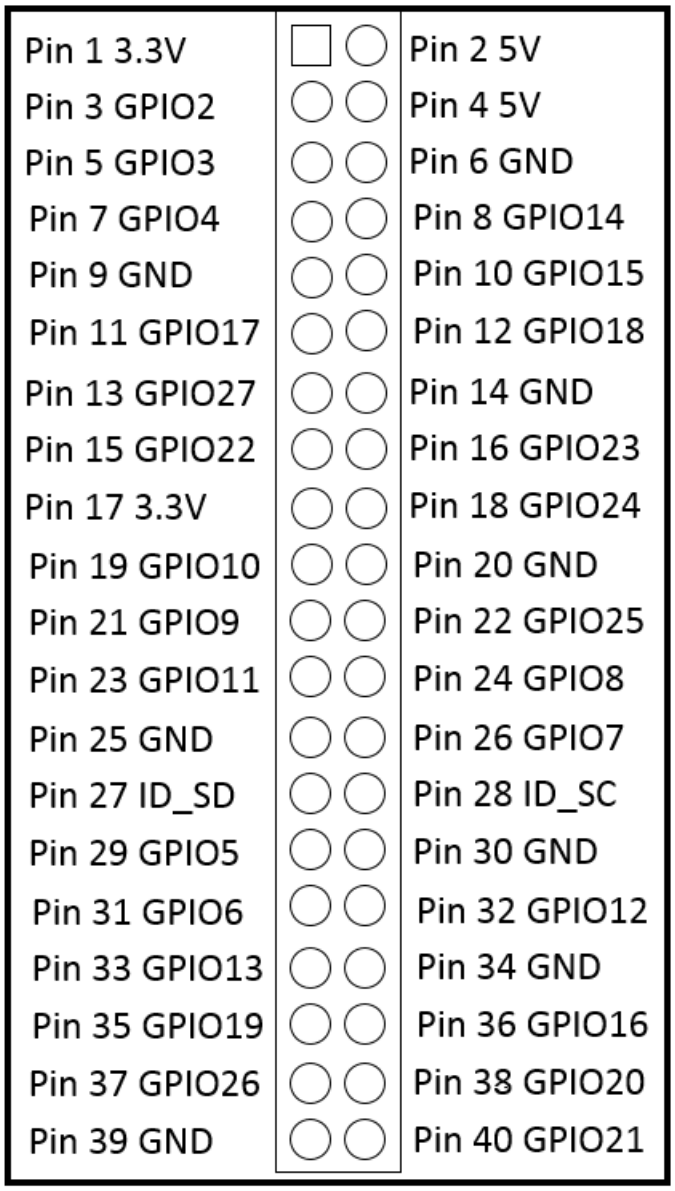

-H TUBE 125°C

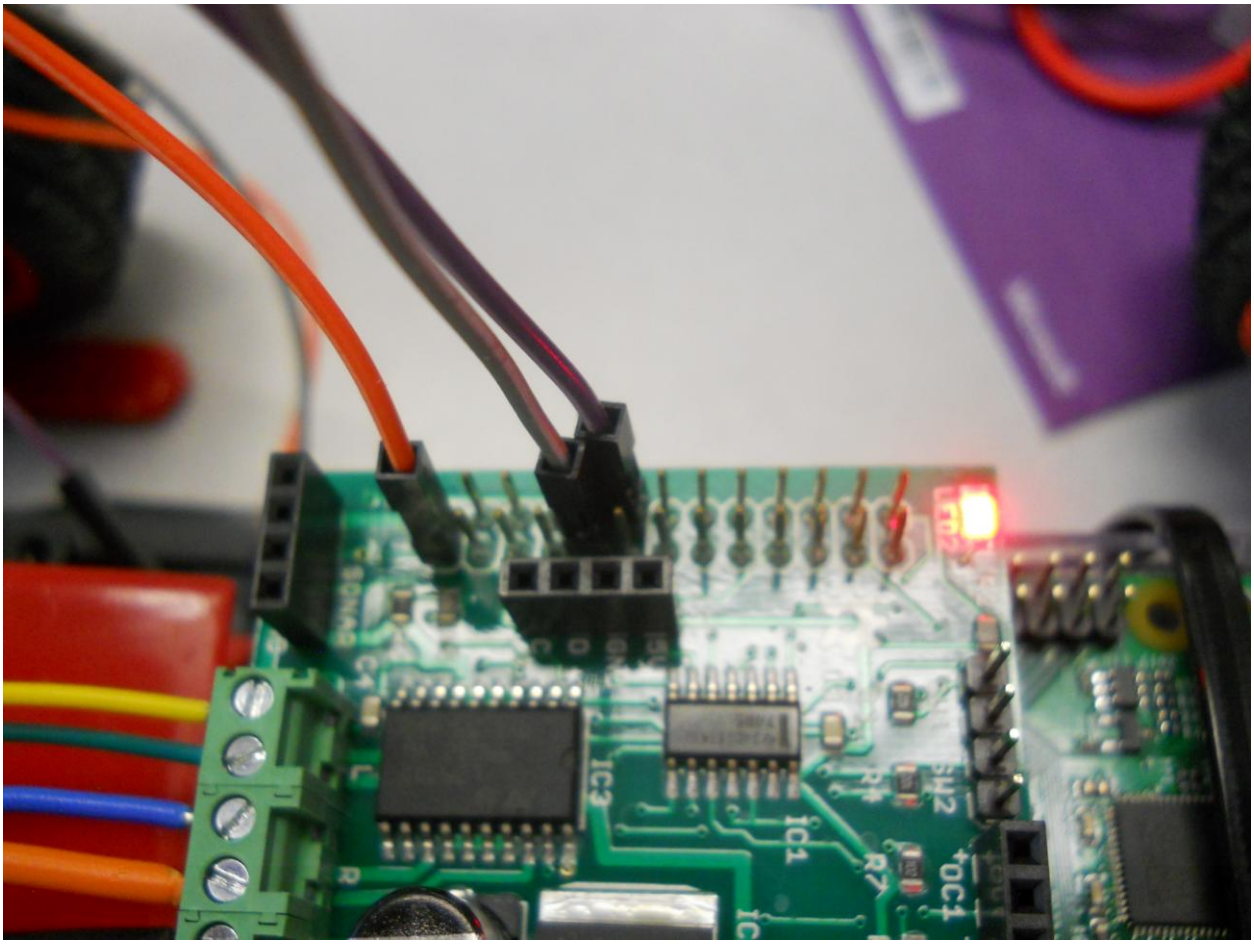

R2
SW1
SW2
R3
R4
C3
IC1
5V
GND
R5
R6
5V T E GND
330
M242
CS
470
16V
CS
330
35V
C2

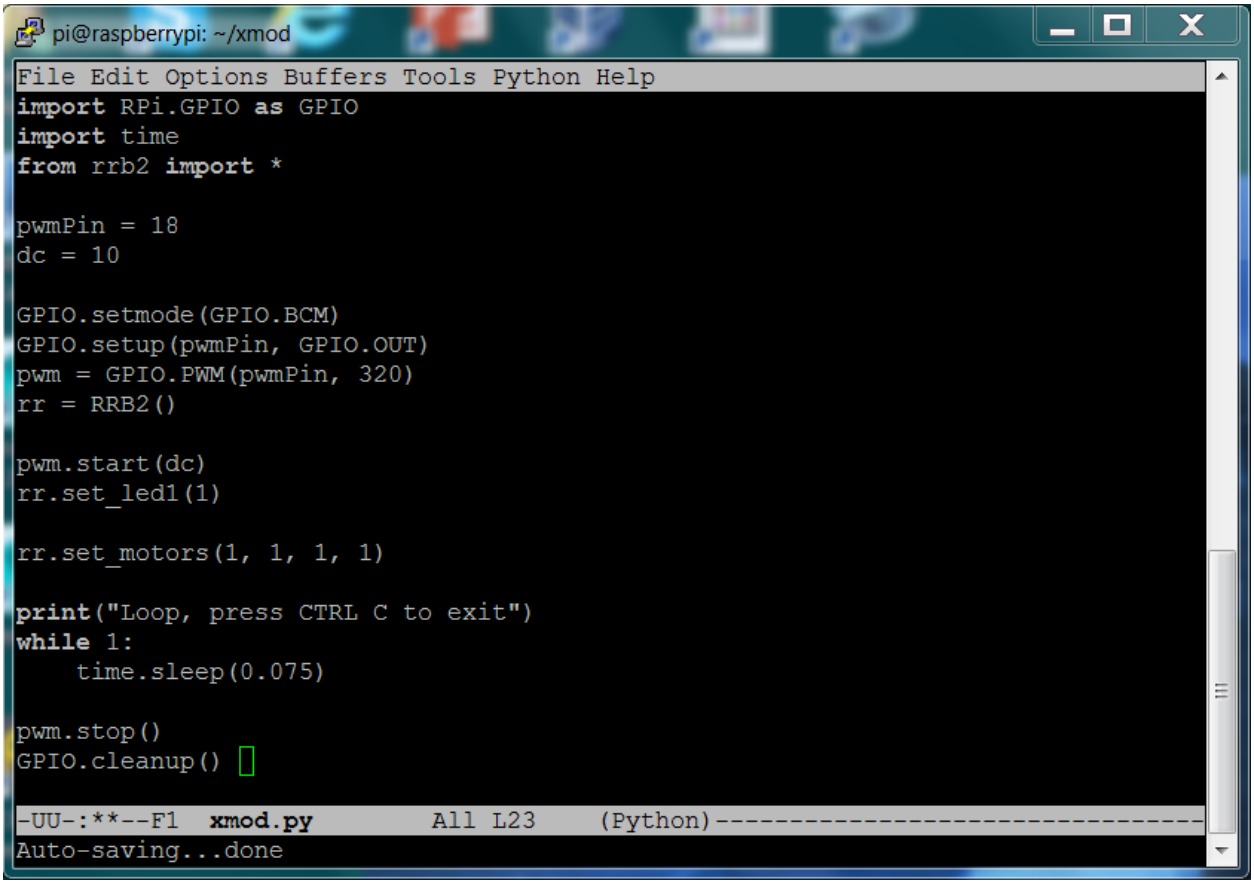

CS
470
16V
CS
330
35V
C2
Vin
5V T E GND

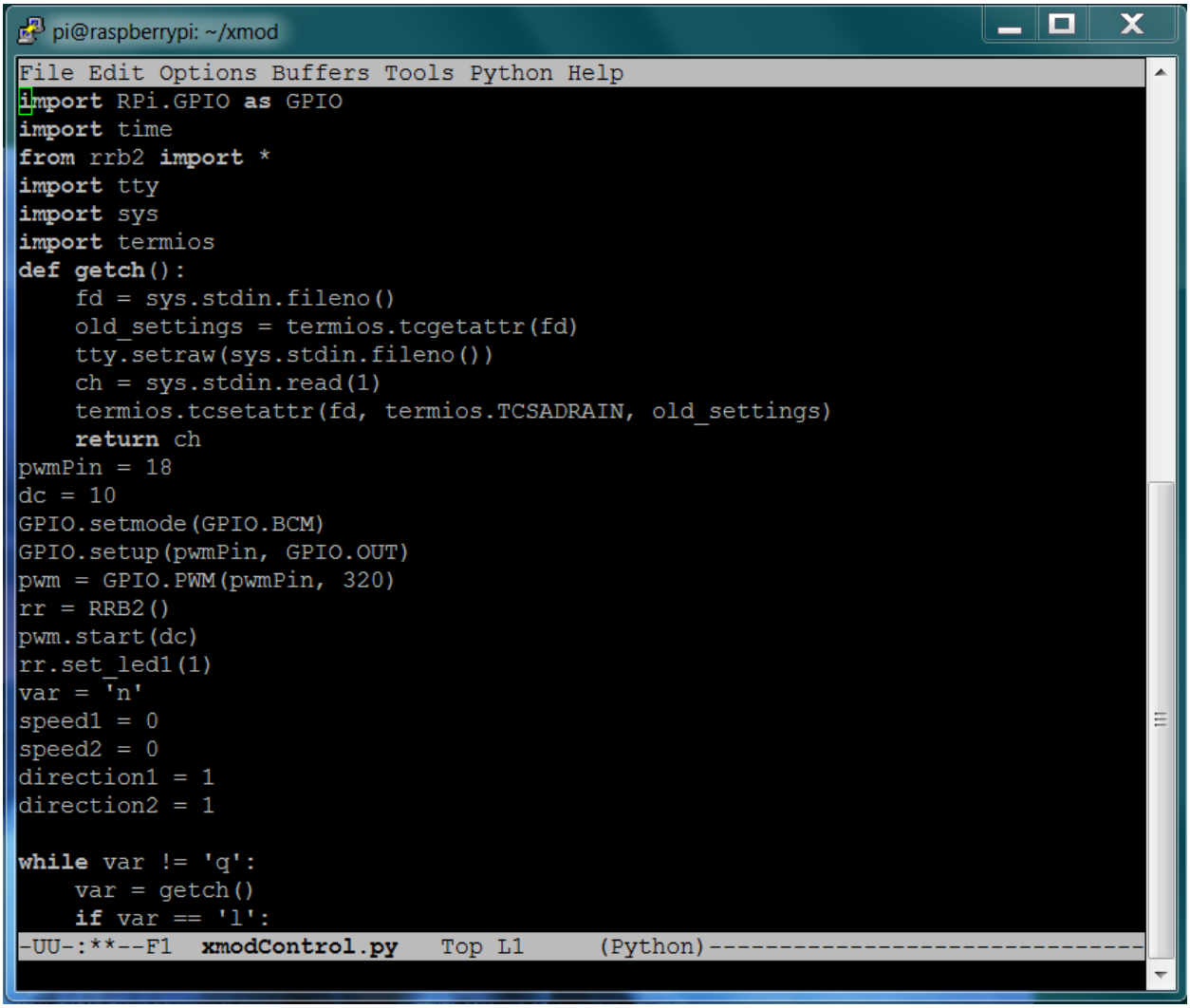

CS
470
16V
CS
330
35V
5V T E GND
Vin
C2

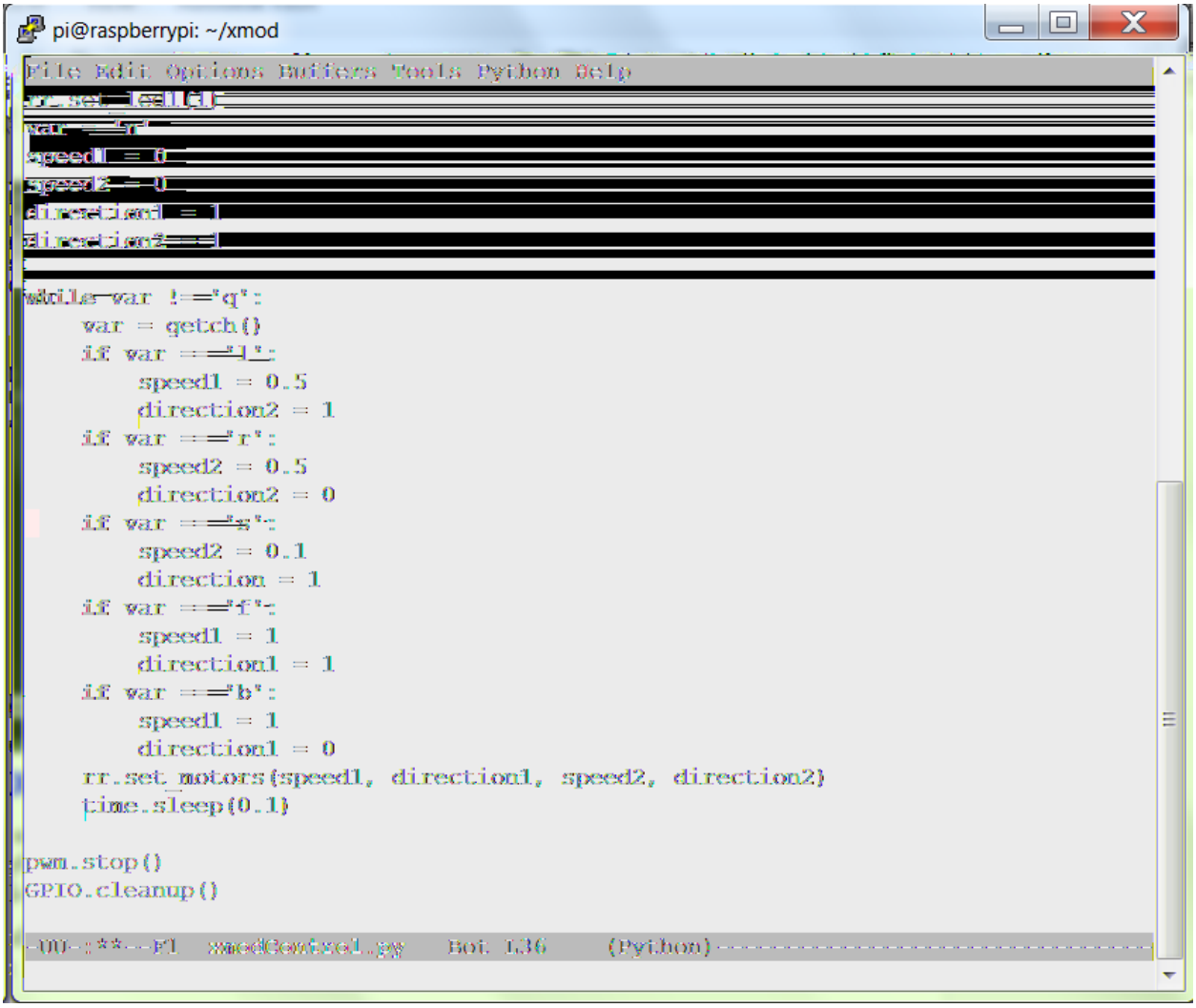

5V T E GND
Vin

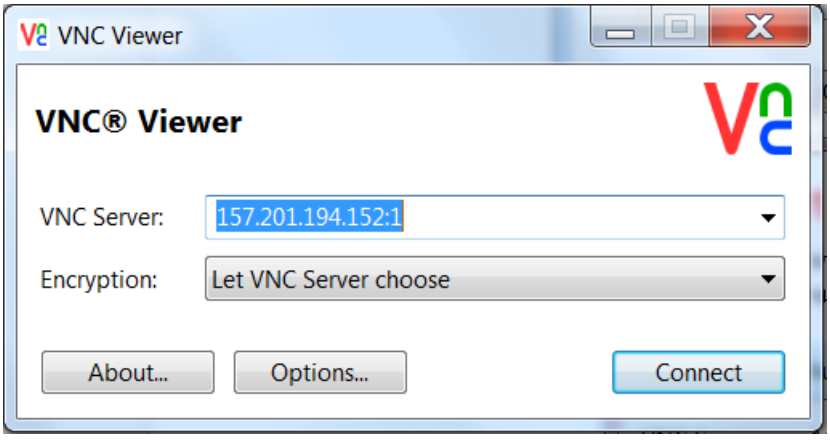

Pin 1 3.3V
Pin 2 5V
Pin 3 GPIO2
Pin 4 5V
Pin 5 GPIO3
Pin 6 GND
Pin 7 GPIO4
Pin 8 GPIO14
Pin 9 GND
Pin 10 GPIO15
Pin 11 GPIO17
Pin 12 GPIO18
Pin 13 GPIO27
Pin 14 GND
Pin 15 GPIO22
Pin 16 GPIO23
Pin 17 3.3V
Pin 18 GPIO24
Pin 19 GPIO10
Pin 20 GND
Pin 21 GPIO9
Pin 22 GPIO25
Pin 23 GPIO11
Pin 24 GPIO8
Pin 25 GND
Pin 26 GPIO7
Pin 27 ID_SD
Pin 28 ID_SC
Pin 29 GPIO5
Pin 30 GND
Pin 31 GPIO6
Pin 32 GPIO12
Pin 33 GPIO13
Pin 34 GND
Pin 35 GPIO19
Pin 36 GPIO16
Pin 37 GPIO26
Pin 38 GPIO20
Pin 39 GND
Pin 40 GPIO21

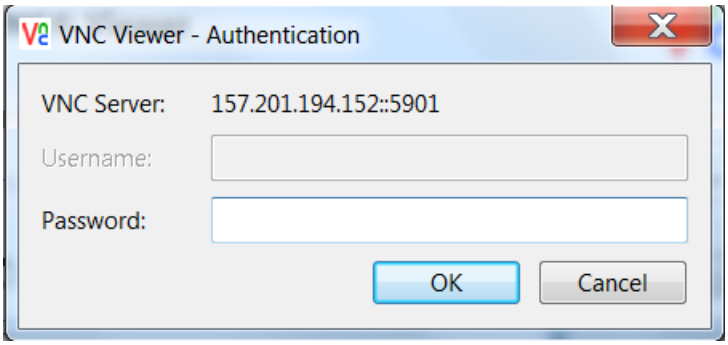

IC3
IC1
R4
R7

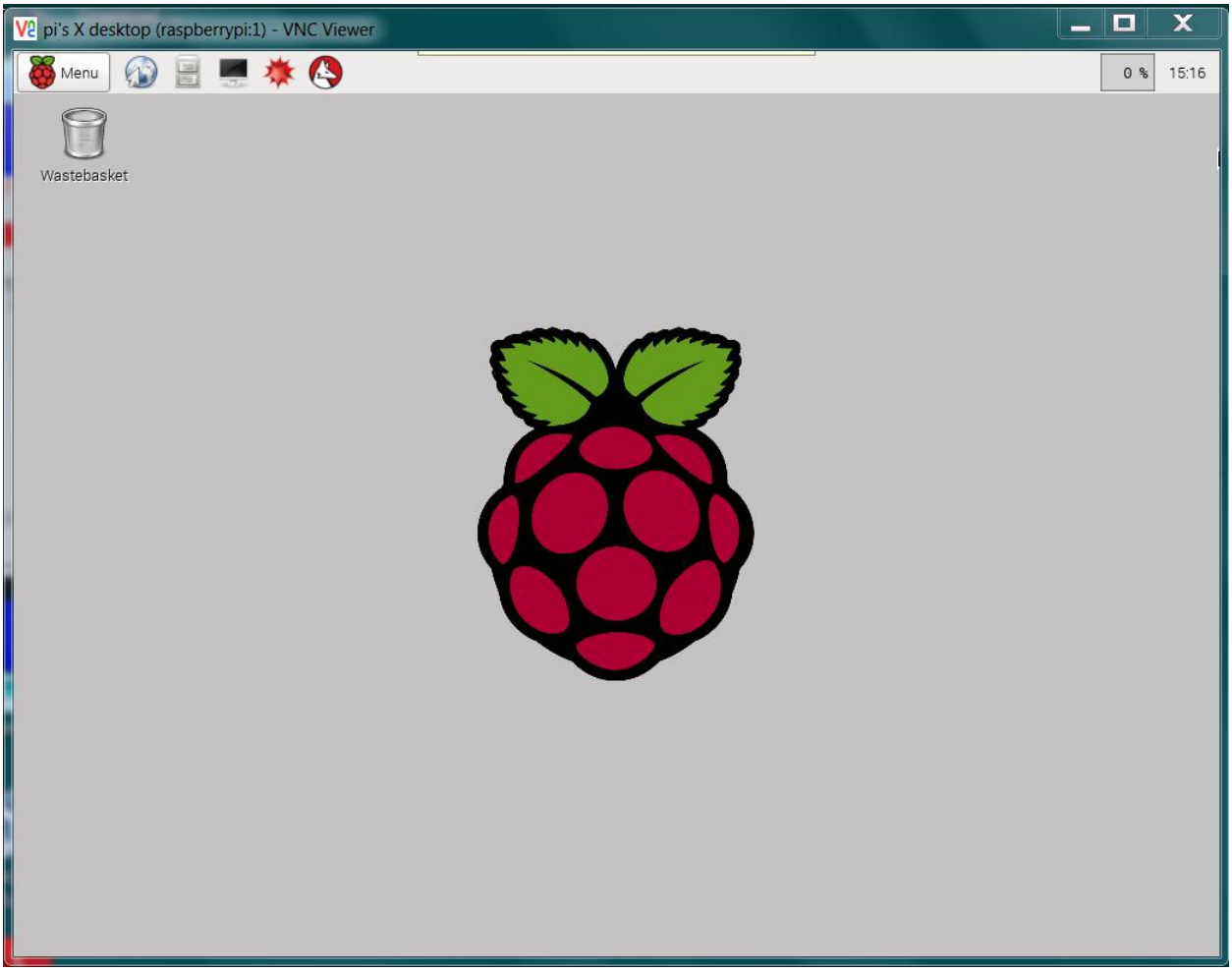

pi@raspberrypi: ~/xmod
File Edit Options Buffers Tools Python Help
import RPi.GPIO as GPIO
import time
from rrb2 import *
pwmPin = 18
dc = 10
GPIO.setmode(GPIO.BCM)
GPIO.setup(pwmPin, GPIO.OUT)
pwm = GPIO.PWM(pwmPin, 320)
rr = RRB2()
pwm.start(dc)
rr.set_led1(1)
rr.set_motors(1, 1, 1, 1)
print("Loop, press CTRL C to exit")
while 1:
time.sleep(0.075)
pwm.stop()
GPIO.cleanup()
-UU-:**--F1 xmod.py All L23 (Python)
Auto-saving...done

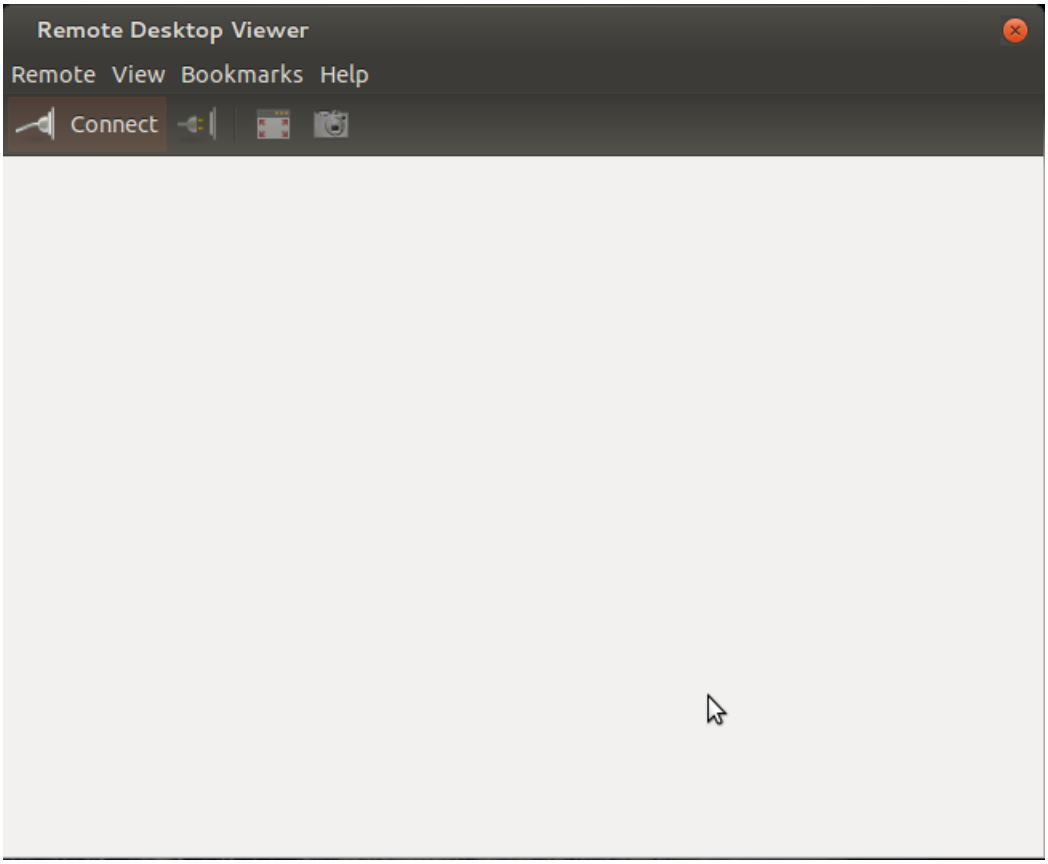

pi@raspberrypi: ~/xmod
File Edit Options Buffers Tools Python Help
import RPi.GPIO as GPIO
import time
from rrb2 import *
import tty
import sys
import termios
def getch():
fd = sys.stdin.fileno()
old_settings = termios.tcgetattr(fd)
tty.setraw(sys.stdin.fileno())
ch = sys.stdin.read(1)
termios.tcsetattr(fd, termios.TCSADRAIN, old_settings)
return ch
pwmPin = 18
dc = 10
GPIO.setmode(GPIO.BCM)
GPIO.setup(pwmPin, GPIO.OUT)
pwm = GPIO.PWM(pwmPin, 320)
rr = RRB2()
pwm.start(dc)
rr.set_led1(1)
var = 'n'
speed1 = 0
speed2 = 0
direction1 = 1
direction2 = 1
while var != 'q':
var = getch()
if var == 'l':
-UU-:**--F1 xmodControl.py Top L1 (Python)

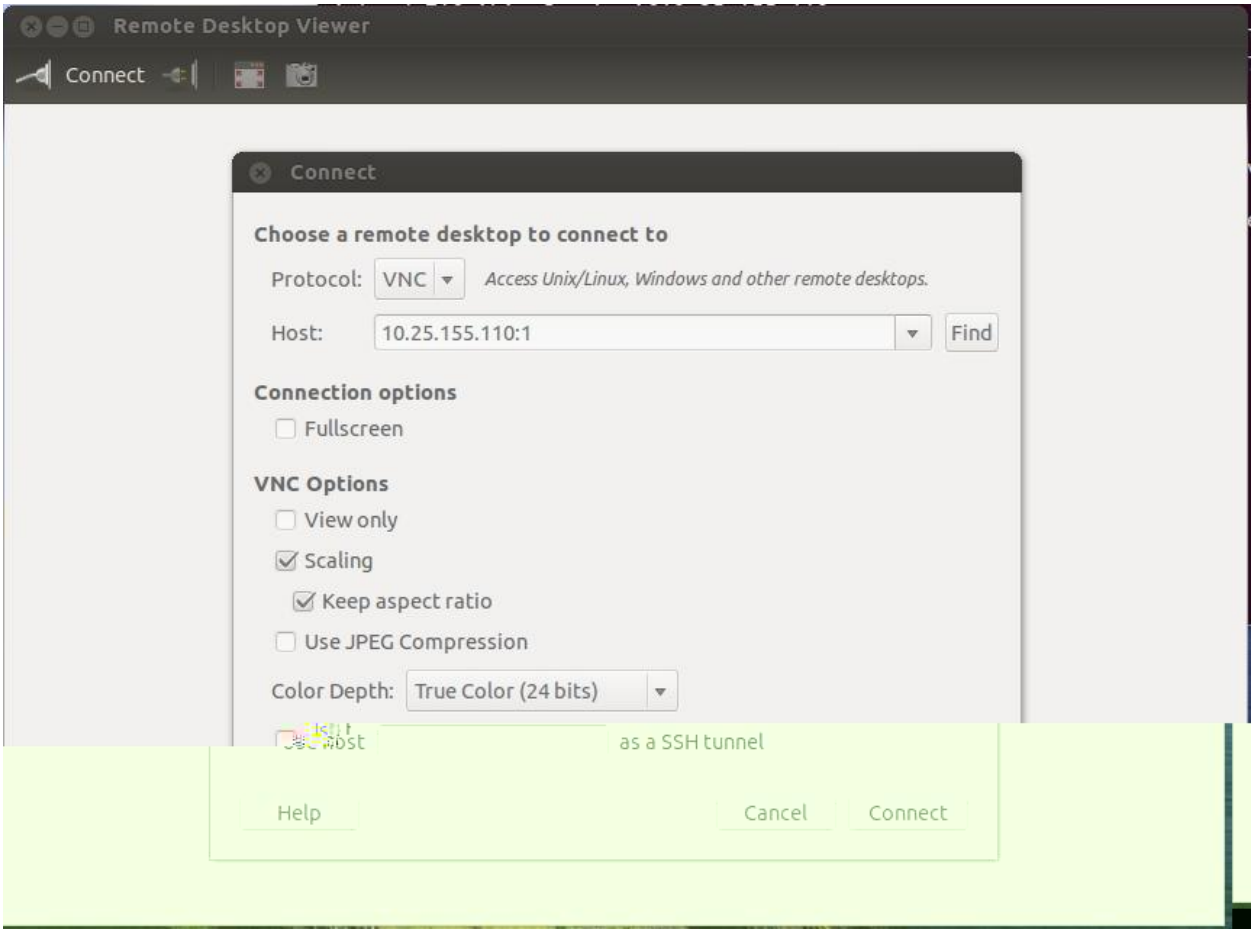

pi@raspberrypi: ~/xmod
File Edit Options Buffers Tools Python Help
while var !='q':
var = getch()
if var =='l':
speed1 = 0.5
direction2 = 1
if var =='r':
speed2 = 0.5
direction2 = 0
if var =='x':
speed2 = 0.1
direction = 1
if var =='f':
speed1 = 1
direction1 = 1
if var =='b':
speed1 = 1
direction1 = 0
rr.set_motors(speed1, direction1, speed2, direction2)
time.sleep(0.1)
pwm.stop()
GPIO.cleanup()

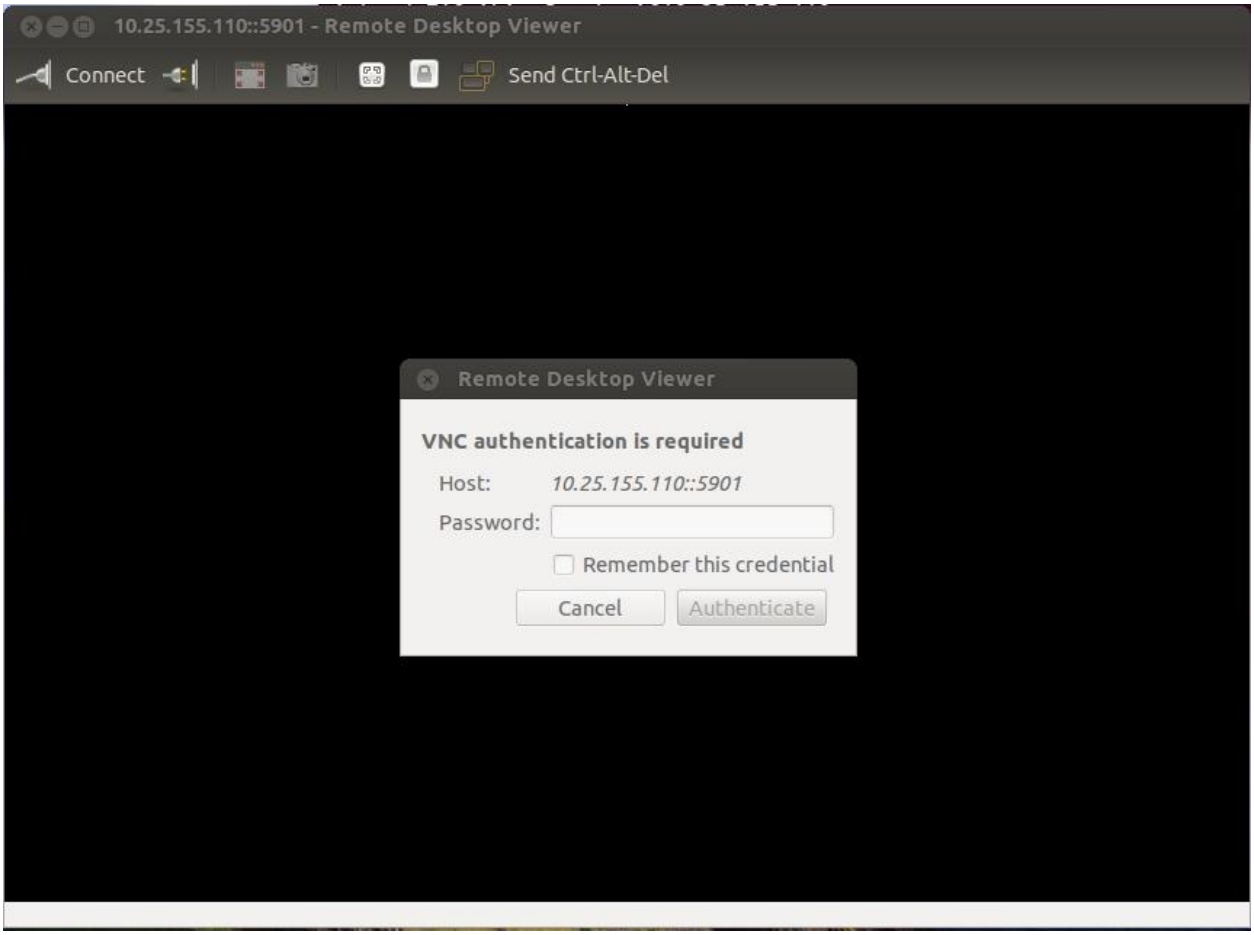

VNC Viewer
VNC® Viewer
VNC Server:
157.201.194.152:1
Encryption:
Let VNC Server choose
About...
Options...
Connect

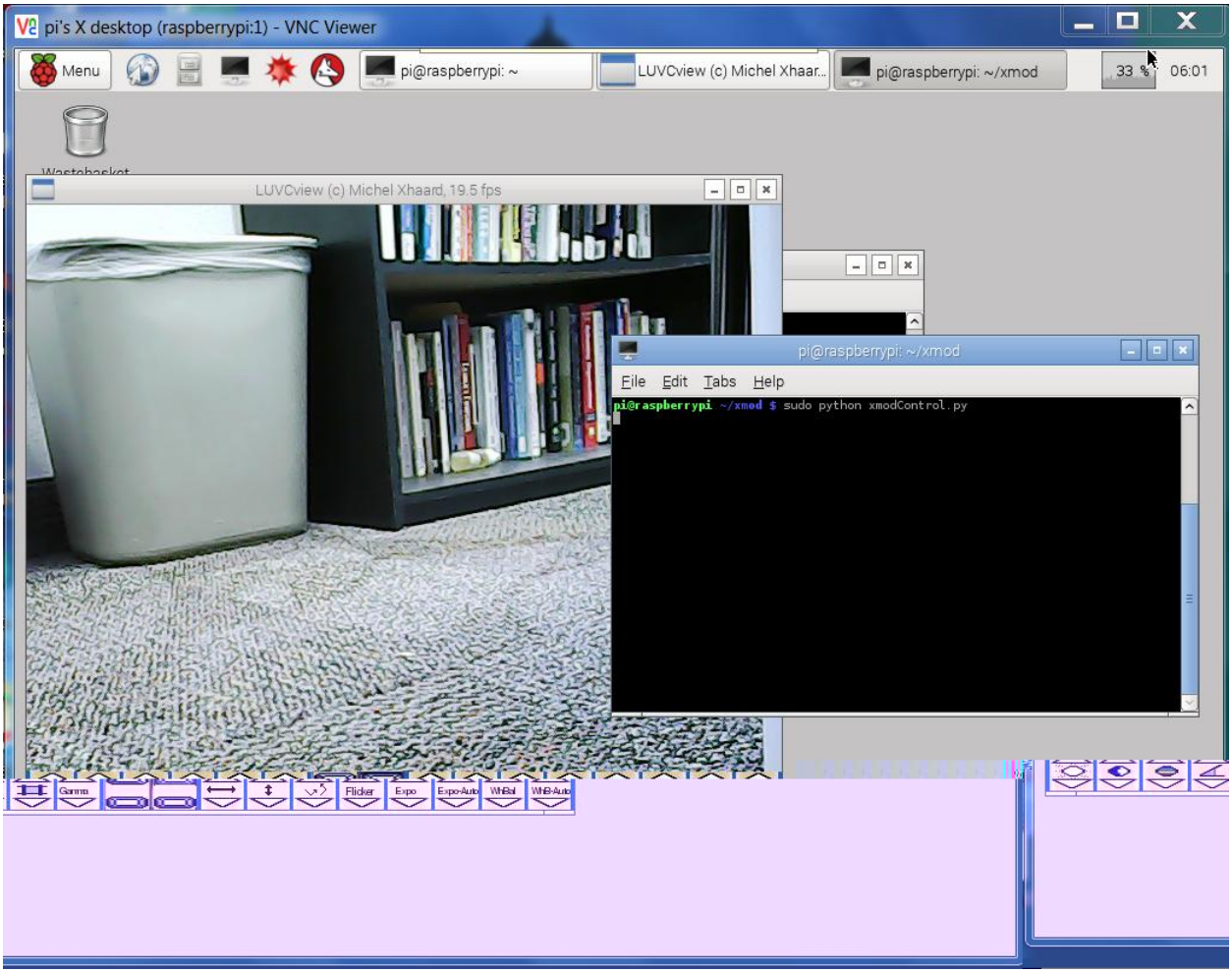

VNC Viewer - Authentication
VNC Server:
157.201.194.152::5901
Username:
Password:
OK
Cancel


pi's X desktop (raspberrypi:1) - VNC Viewer
Menu
0 %
15:16
Wastebasket

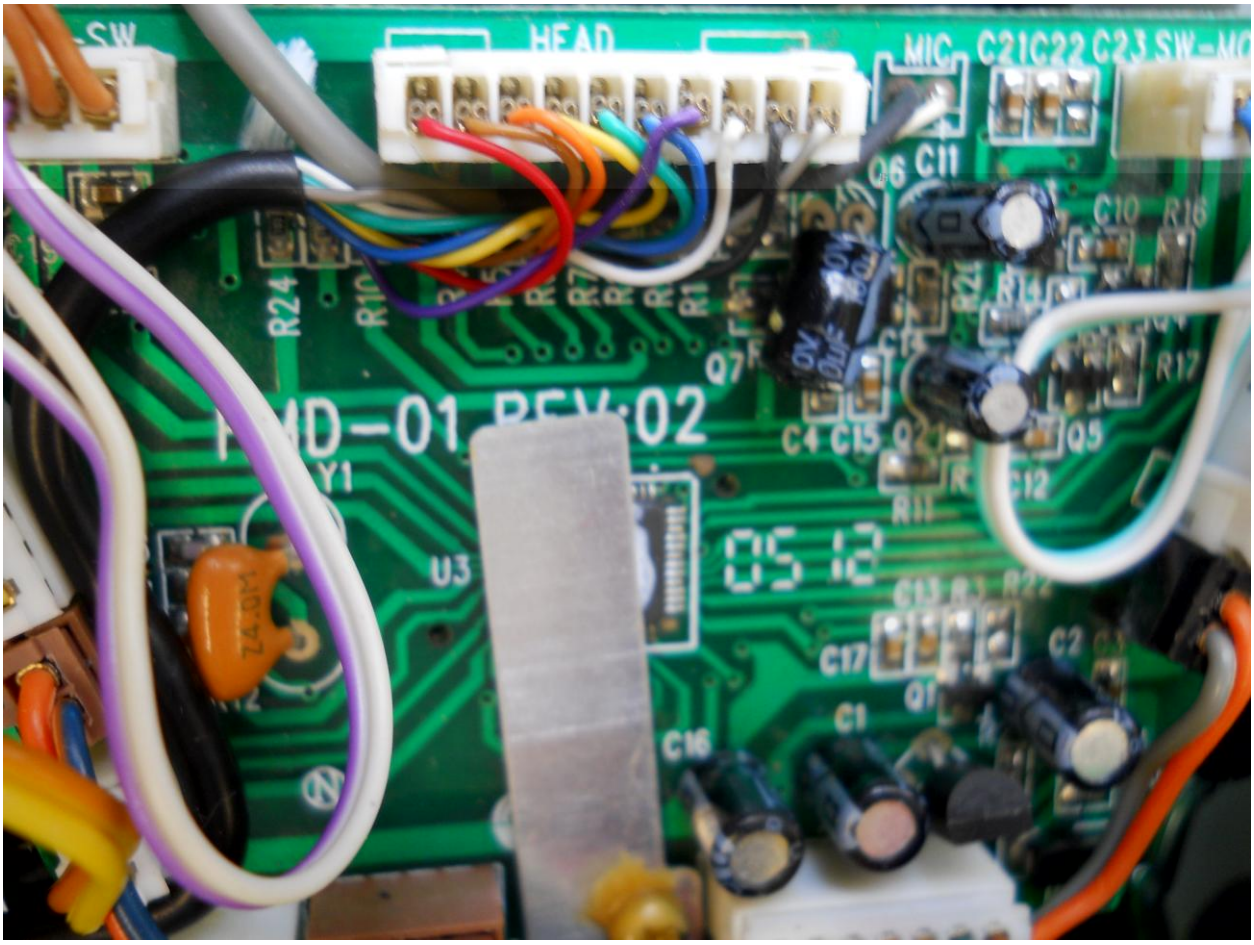

Remote Desktop Viewer
Remote View Bookmarks Help
Connect

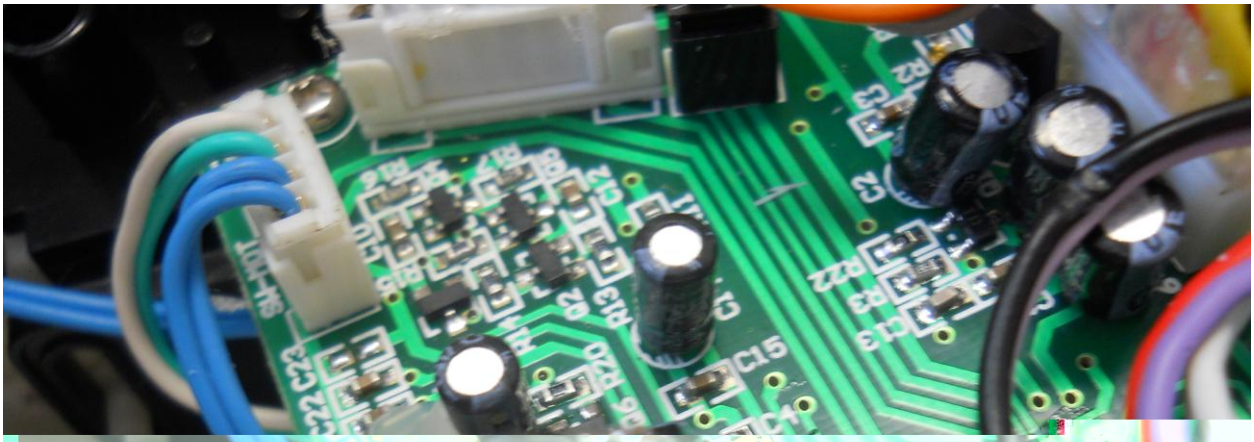

Remote Desktop Viewer
Connect
Connect
Choose a remote desktop to connect to
Protocol:
VNC
Access Unix/Linux, Windows and other remote desktops.
Host:
10.25.155.110:1
Find
Connection options
Fullscreen
VNC Options
View only
Scaling
Keep aspect ratio
Use JPEG Compression
Color Depth:
True Color (24 bits)
as a SSH tunnel
Help
Cancel
Connect

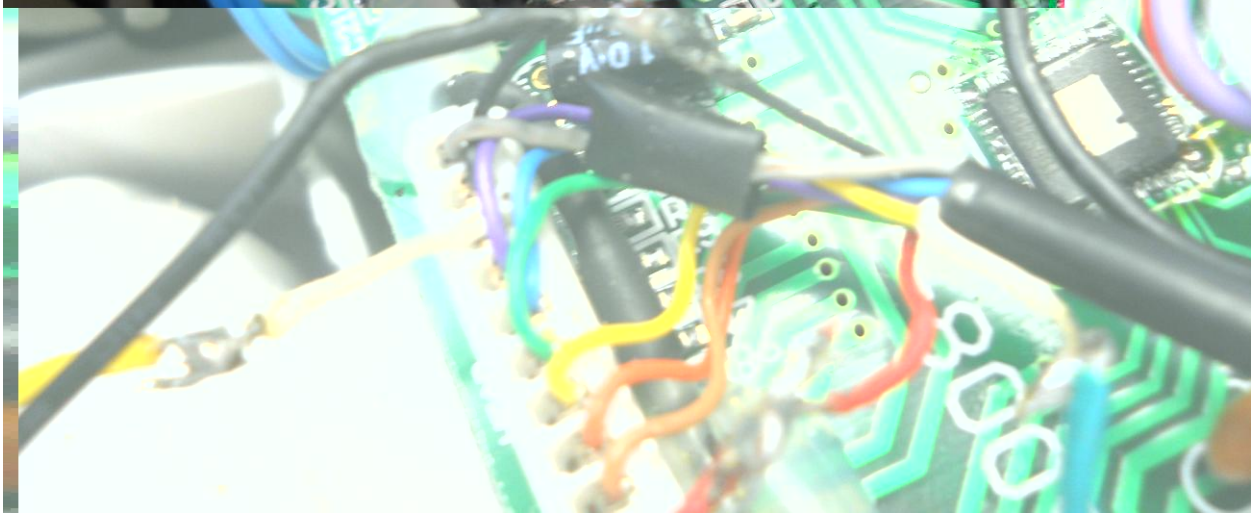

10.25.155.110::5901 - Remote Desktop Viewer
Connect
Send Ctrl-Alt-Del
Remote Desktop Viewer
VNC authentication is required
Host:
10.25.155.110::5901
Password:
Remember this credential
Cancel
Authenticate

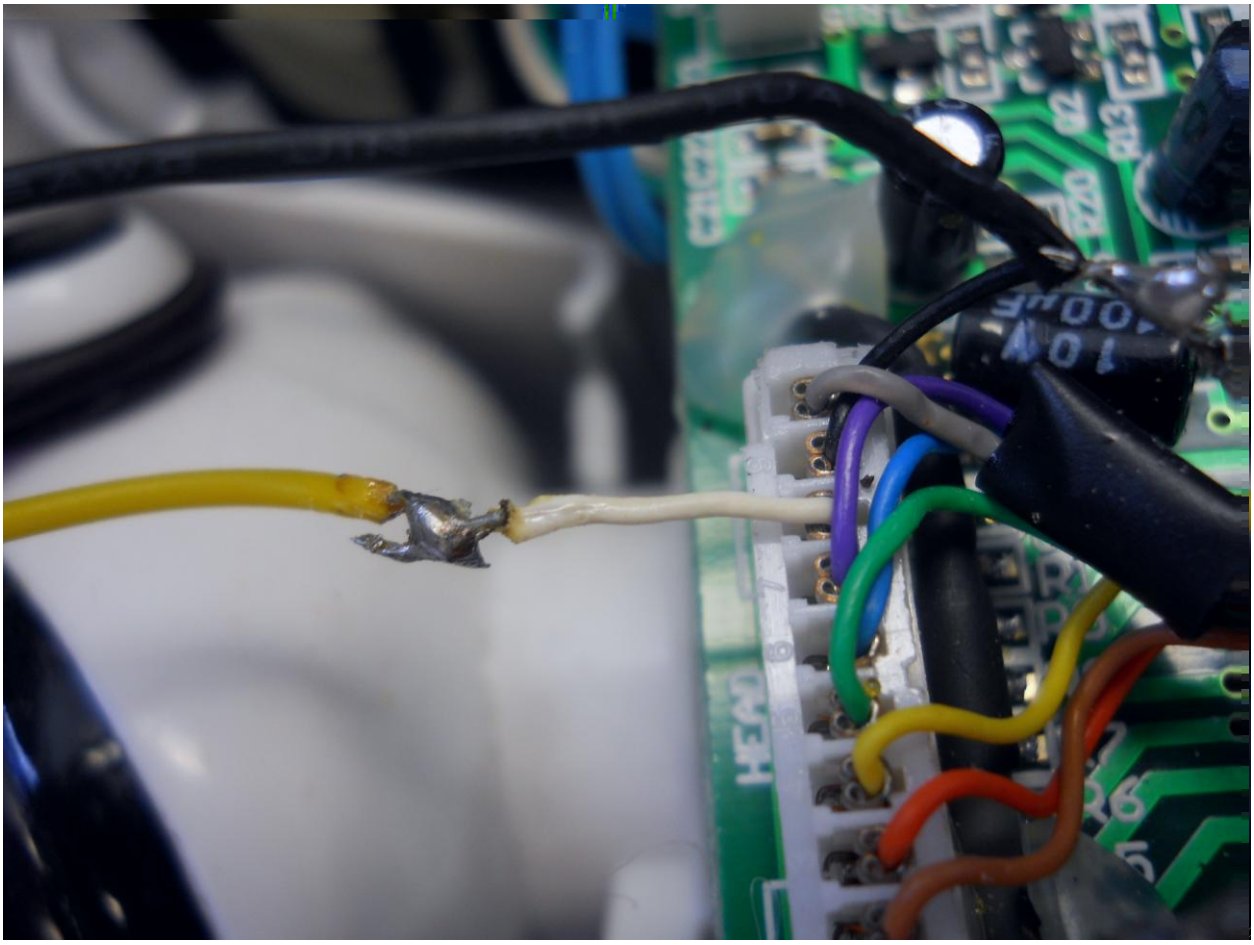

pi's X desktop (raspberrypi:1) - VNC Viewer
Menu
pi@raspberrypi: ~
LUVCview (c) Michel Xhaar...
pi@raspberrypi: ~/xmod
33 %
06:01
Wastebasket
LUVCview (c) Michel Xhaard, 19.5 fps
pi@raspberrypi: ~/xmod
File Edit Tabs Help
pi@raspberrypi ~/xmod $ sudo python xmodControl.py
Gamma
Flicker
Expo
Expo-Auto
WhtBal
WhtB-Auto

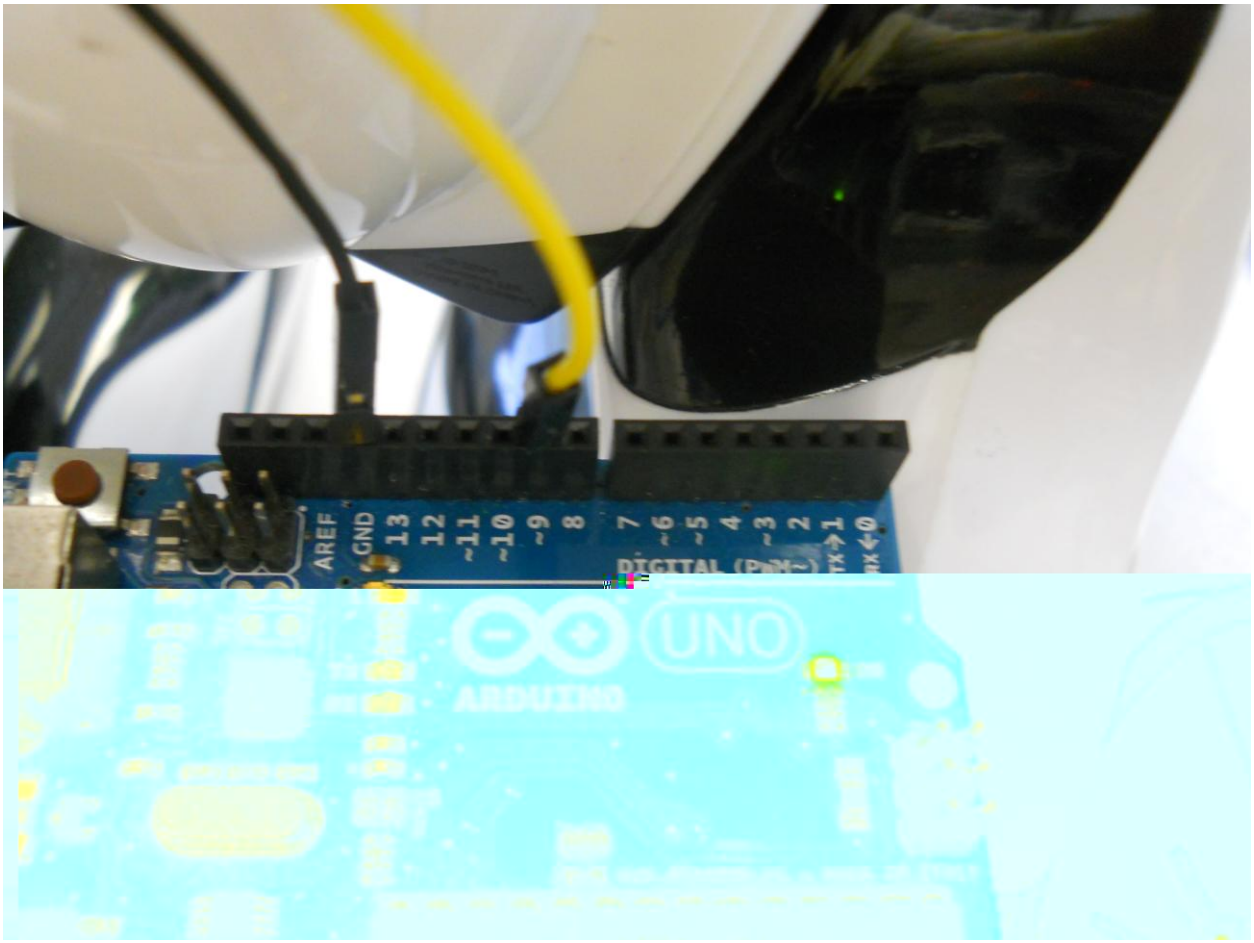
Chapter 2: Adding Raspberry Pi to a Humanoid Robot


HEAD
MIC
C21C22 C23 SW-MC
Q6 C11
C10 R16
R24
R10
R7
R2
R1
Q7
R14
R17
Q5
C4 C15
C12
R11
Y1
U3
05 12
C13 R3 R22
C17
C2
Q1
C1
C16


C15
C14


10-V

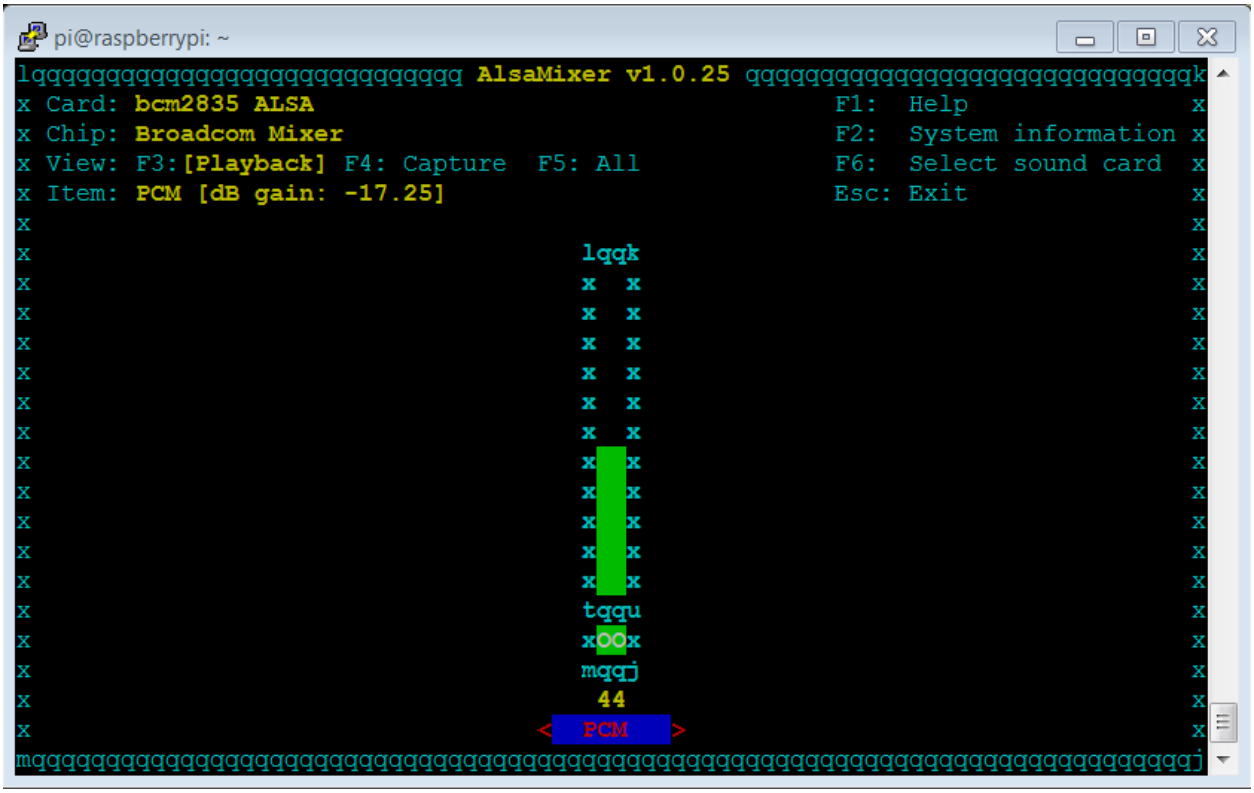


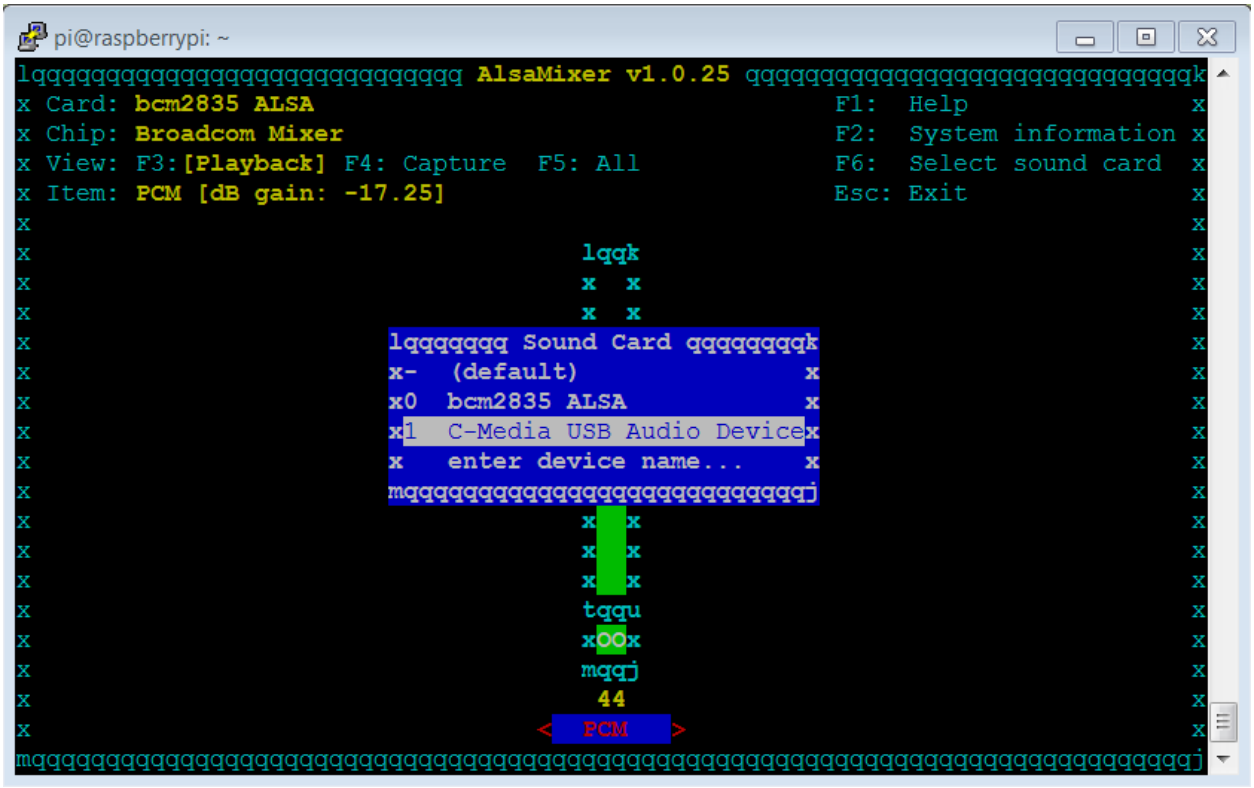

AREF
GND
13
12
~11
~10
~9
8
7
~6
~5
4
~3
2
TX→1
RX←0
DIGITAL (PWM~)
UNO
ARDUINO

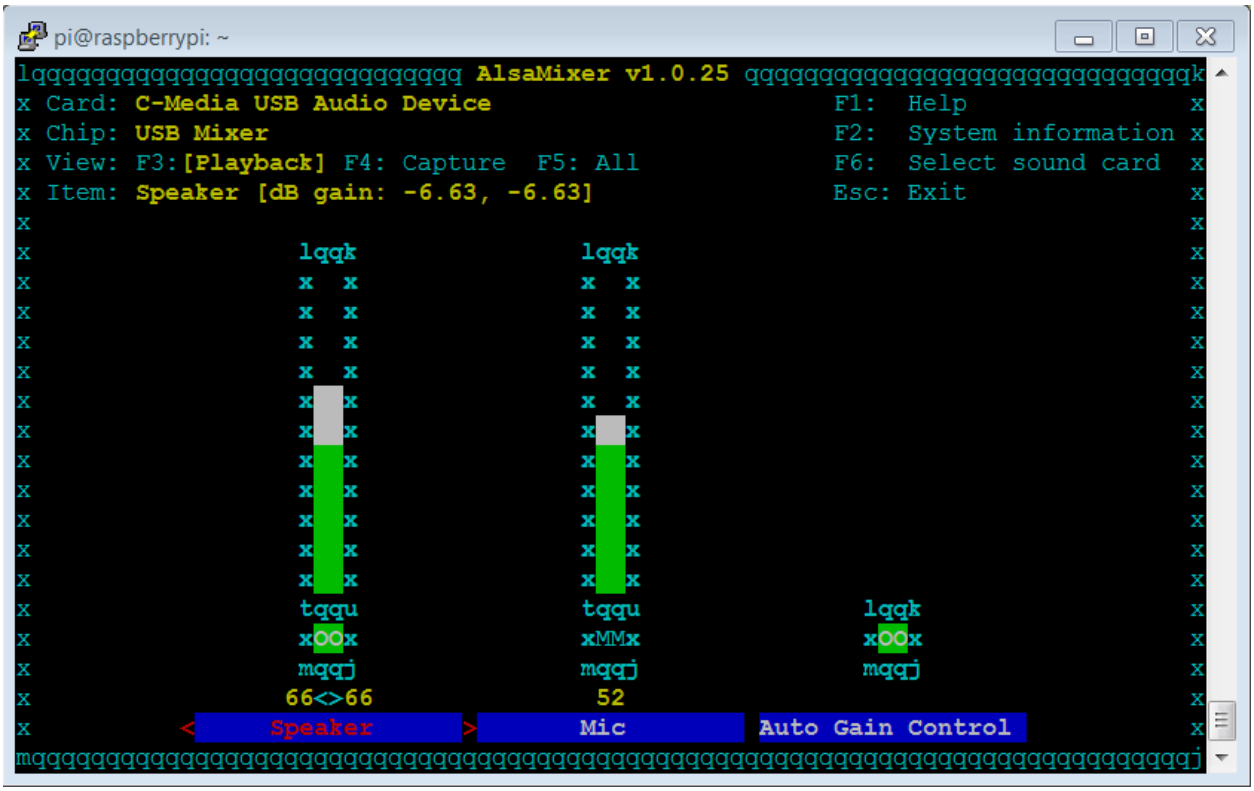
pi@raspberrypi: ~/wowee

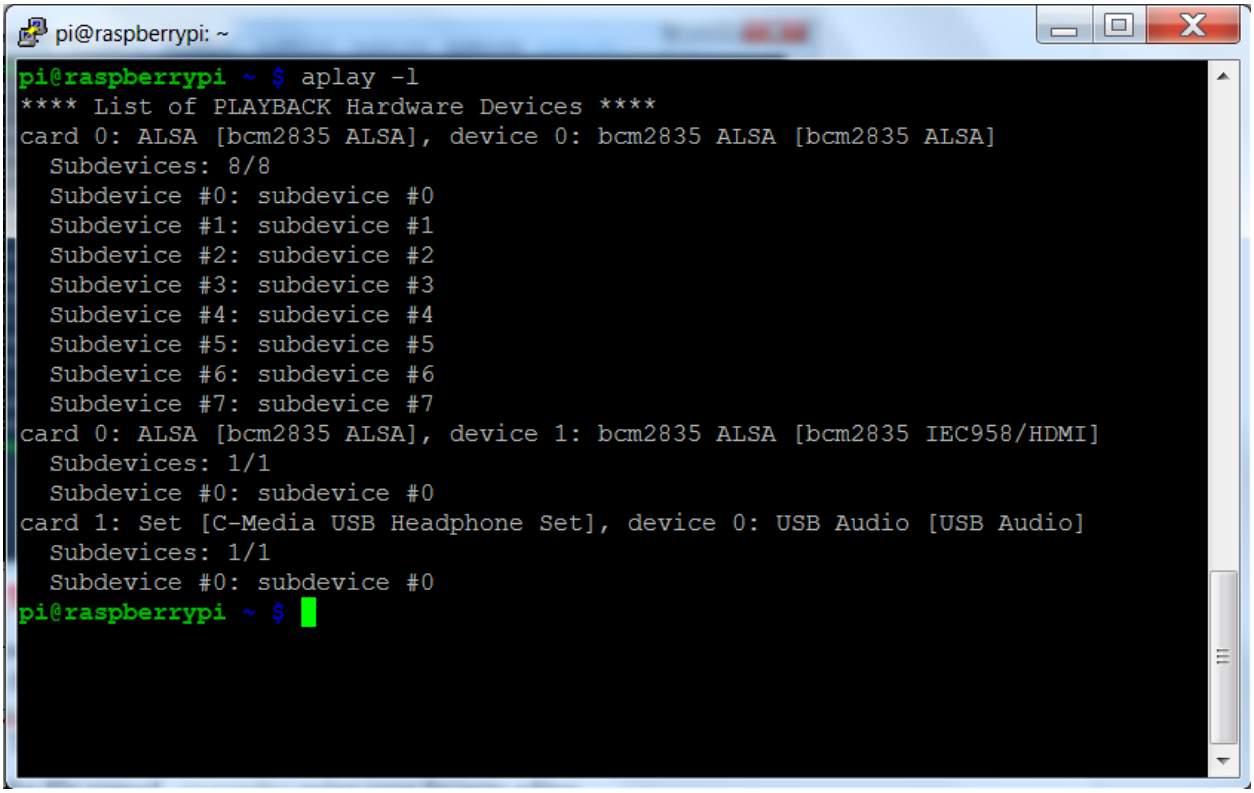
```
File Edit Options Buffers Tools Python Help
#!/usr/bin/python

import serial
import sys

ser = serial.Serial('/dev/ttyACM0', 9600, timeout = 1)
total = len(sys.argv)
cmdargs = str(sys.argv)

if total > 1:
    x = sys.argv[1]
    ser.write(x);
    s = ser.read(100);
#    print s

-UU-:----F1  argControl.py    All L1      (Python)----------------------------------
For information about GNU Emacs and the GNU system, type C-h C-a.
```

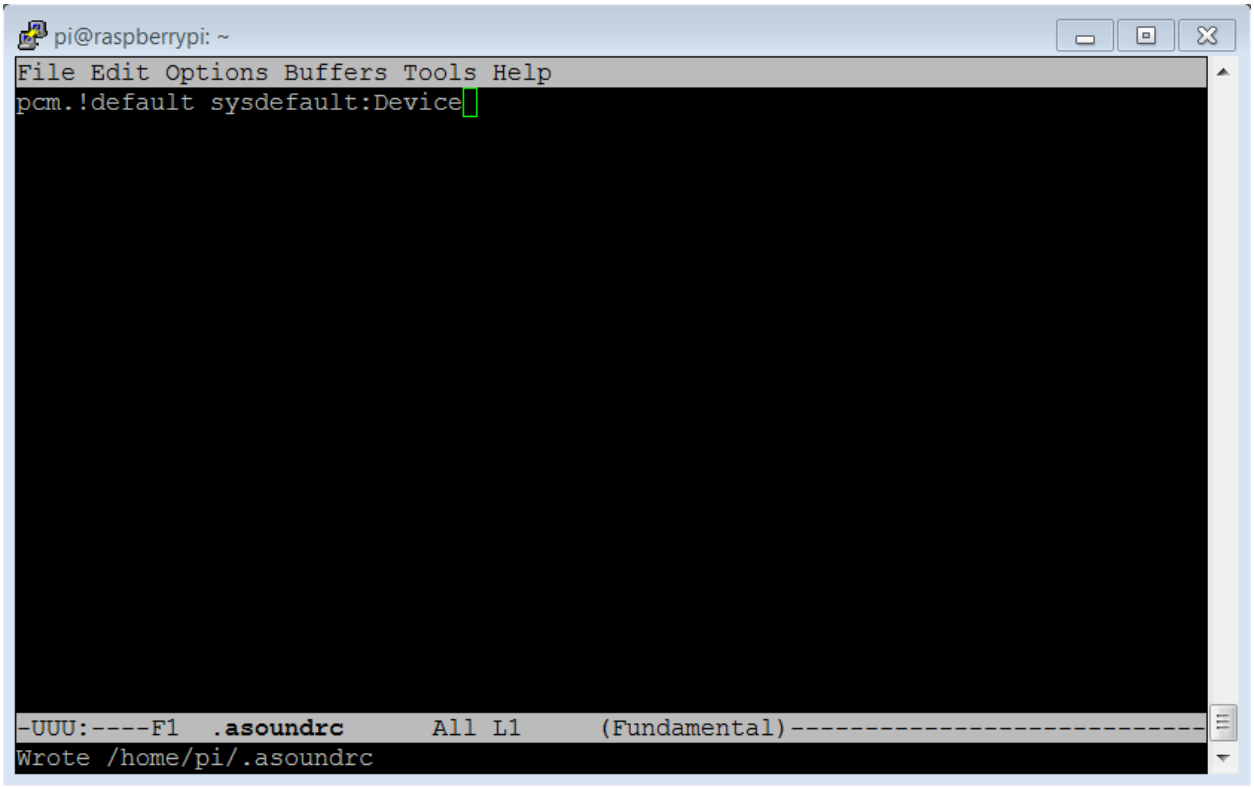
```
pi@raspberrypi: ~
pi@raspberrypi ~ $ cat /proc/asound/cards
 0 [ALSA           ]: bcm2835 - bcm2835 ALSA
                      bcm2835 ALSA
 1 [Set            ]: USB-Audio - C-Media USB Headphone Set
                      C-Media USB Headphone Set at usb-bcm2708_usb-1.4, full spe
ed
pi@raspberrypi ~ $
```

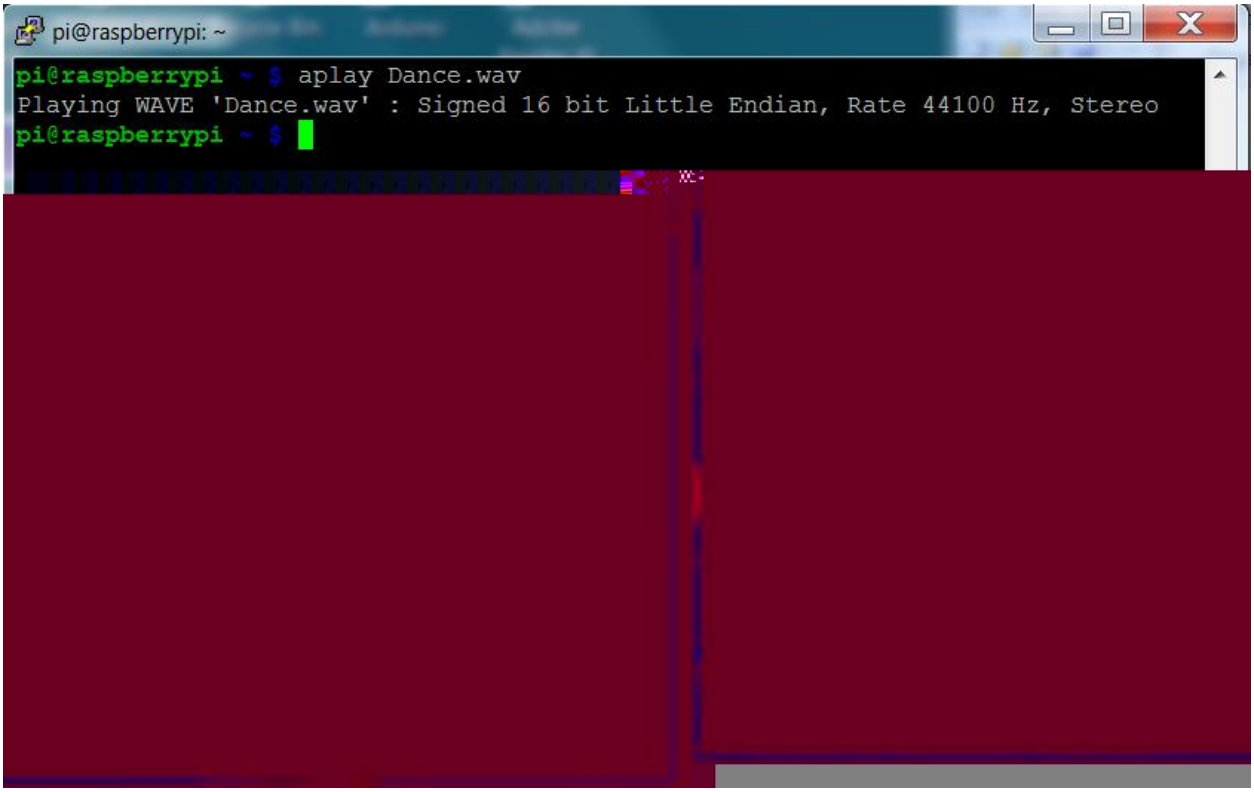

pi@raspberrypi: ~
AlsaMixer v1.0.25
Card: bcm2835 ALSA
Chip: Broadcom Mixer
View: F3:[Playback] F4: Capture F5: All
Item: PCM [dB gain: -17.25]
F1: Help
F2: System information
F6: Select sound card
Esc: Exit
44
PCM

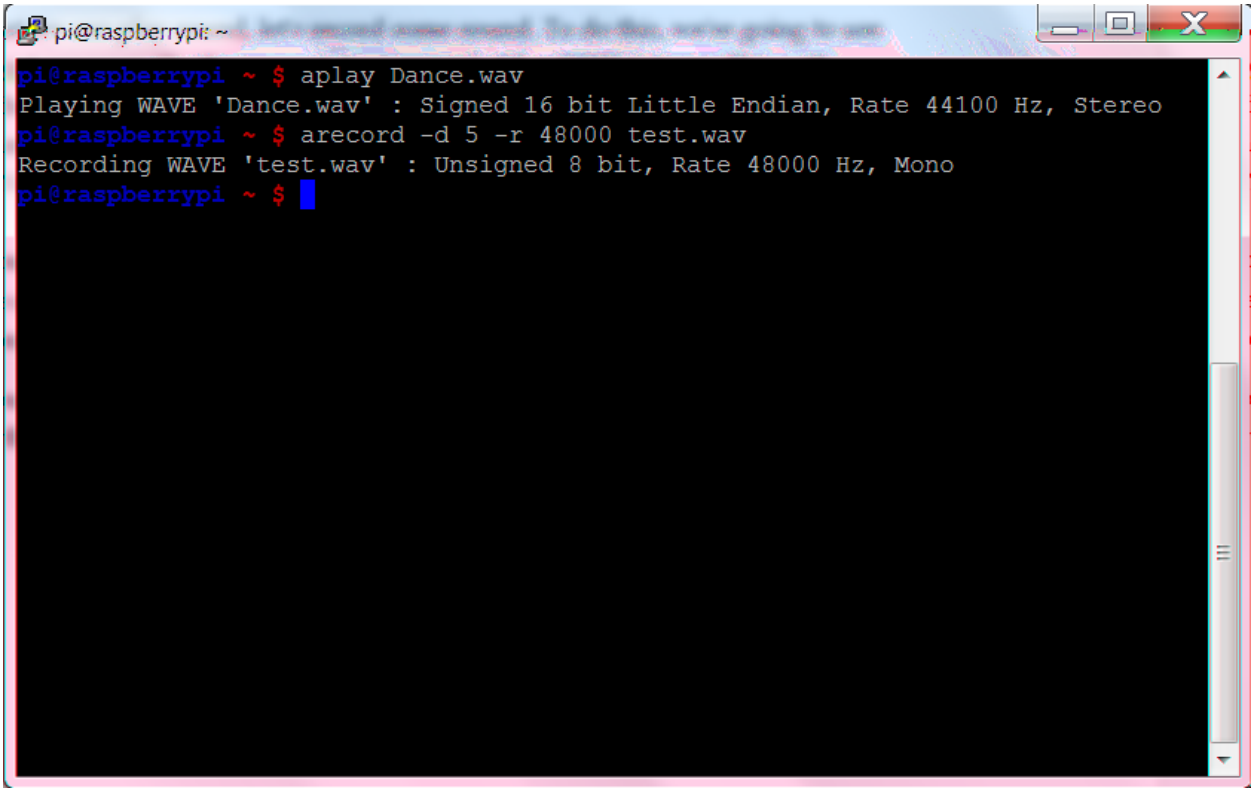

pi@raspberrypi: ~
AlsaMixer v1.0.25
Card: bcm2835 ALSA
Chip: Broadcom Mixer
View: F3:[Playback] F4: Capture F5: All
Item: PCM [dB gain: -17.25]
F1: Help
F2: System information
F6: Select sound card
Esc: Exit
Sound Card
(default)
0 bcm2835 ALSA
1 C-Media USB Audio Device
enter device name...
44
PCM

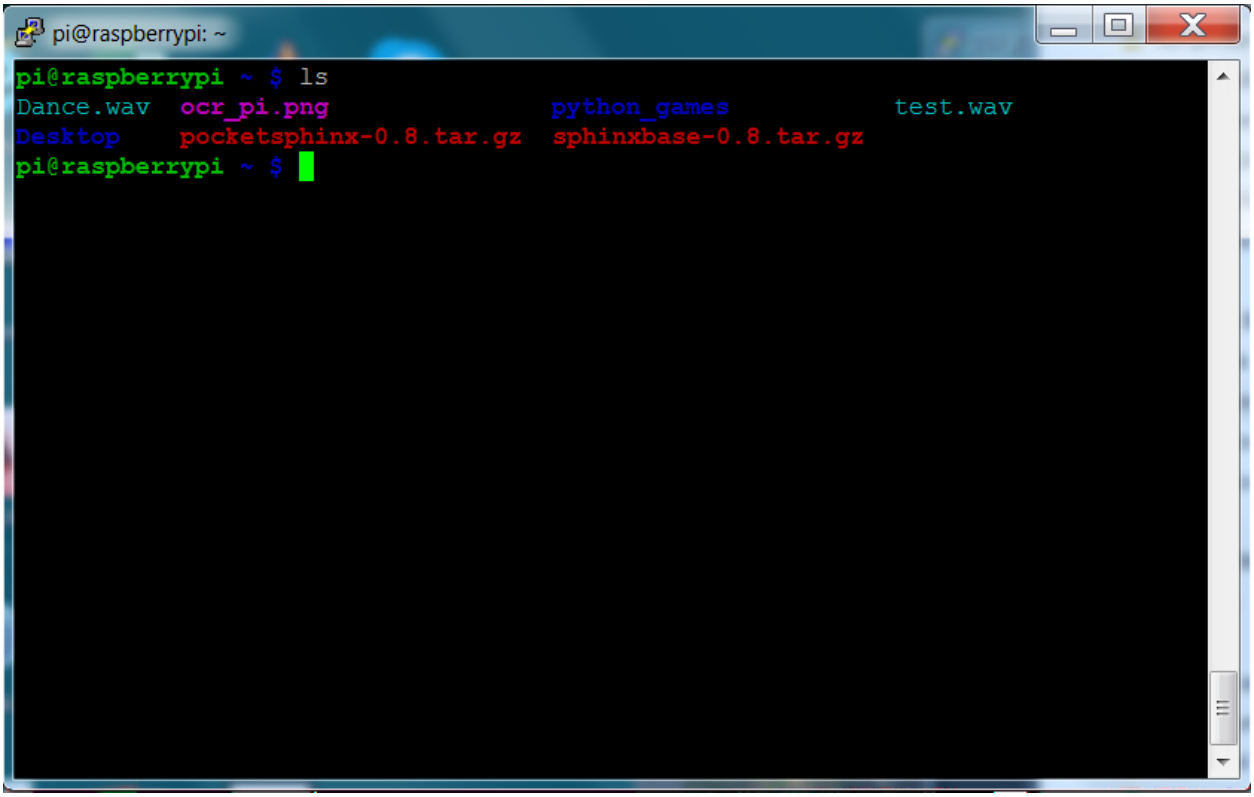

pi@raspberrypi: ~
AlsaMixer v1.0.25
Card: C-Media USB Audio Device
Chip: USB Mixer
View: F3:[Playback] F4: Capture F5: All
Item: Speaker [dB gain: -6.63, -6.63]
F1: Help
F2: System information
F6: Select sound card
Esc: Exit
66<>66
52
Speaker
Mic
Auto Gain Control

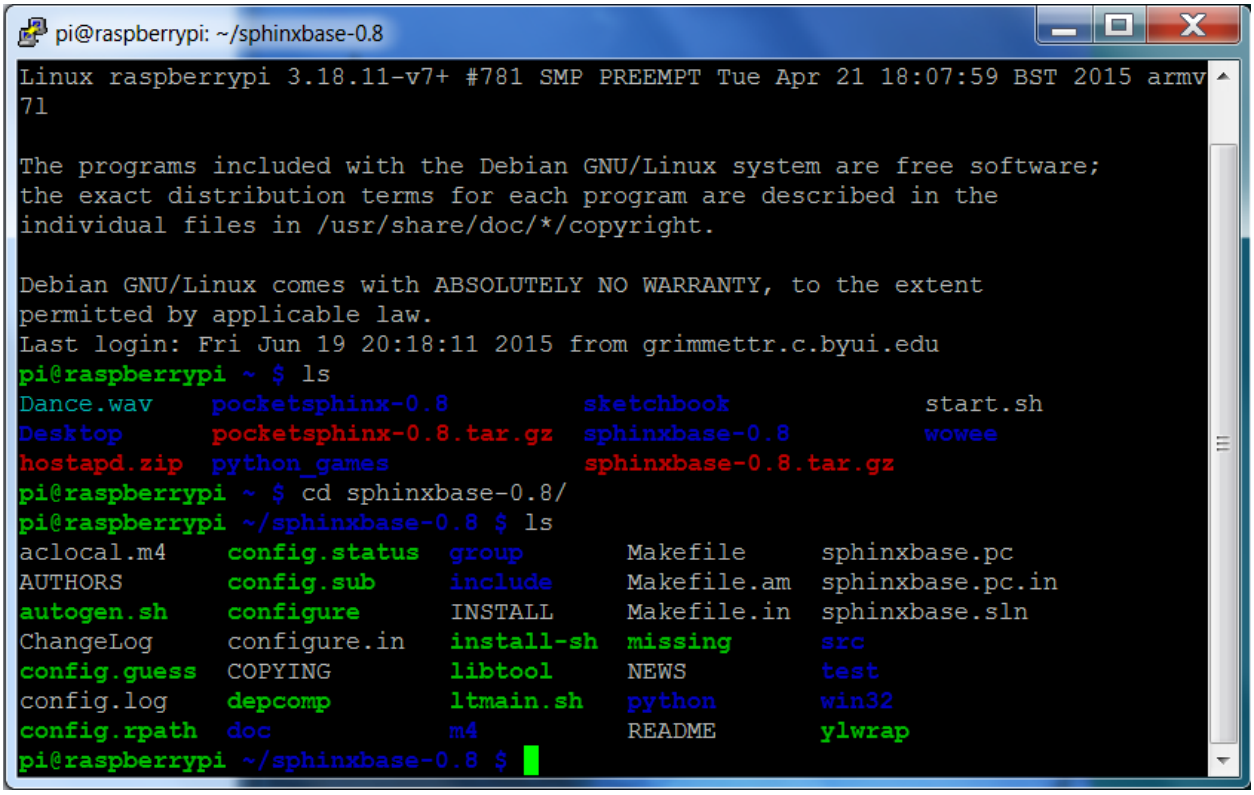

pi@raspberrypi: ~
pi@raspberrypi ~ $ aplay -l
**** List of PLAYBACK Hardware Devices ****
card 0: ALSA [bcm2835 ALSA], device 0: bcm2835 ALSA [bcm2835 ALSA]
Subdevices: 8/8
Subdevice #0: subdevice #0
Subdevice #1: subdevice #1
Subdevice #2: subdevice #2
Subdevice #3: subdevice #3
Subdevice #4: subdevice #4
Subdevice #5: subdevice #5
Subdevice #6: subdevice #6
Subdevice #7: subdevice #7
card 0: ALSA [bcm2835 ALSA], device 1: bcm2835 ALSA [bcm2835 IEC958/HDMI]
Subdevices: 1/1
Subdevice #0: subdevice #0
card 1: Set [C-Media USB Headphone Set], device 0: USB Audio [USB Audio]
Subdevices: 1/1
Subdevice #0: subdevice #0
pi@raspberrypi ~ $

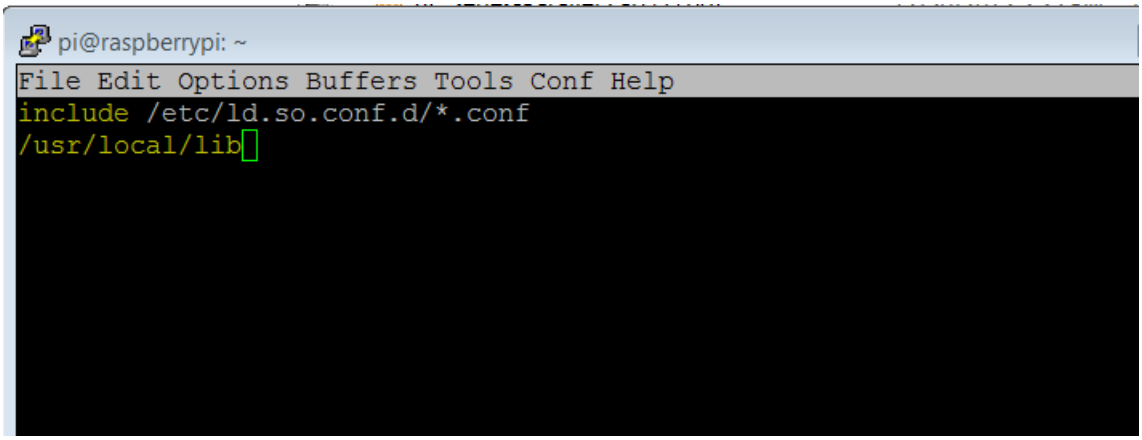

pi@raspberrypi: ~
File Edit Options Buffers Tools Help
pcm.!default sysdefault:Device
-UUU:----F1 .asoundrc   All L1   (Fundamental)----------
Wrote /home/pi/.asoundrc

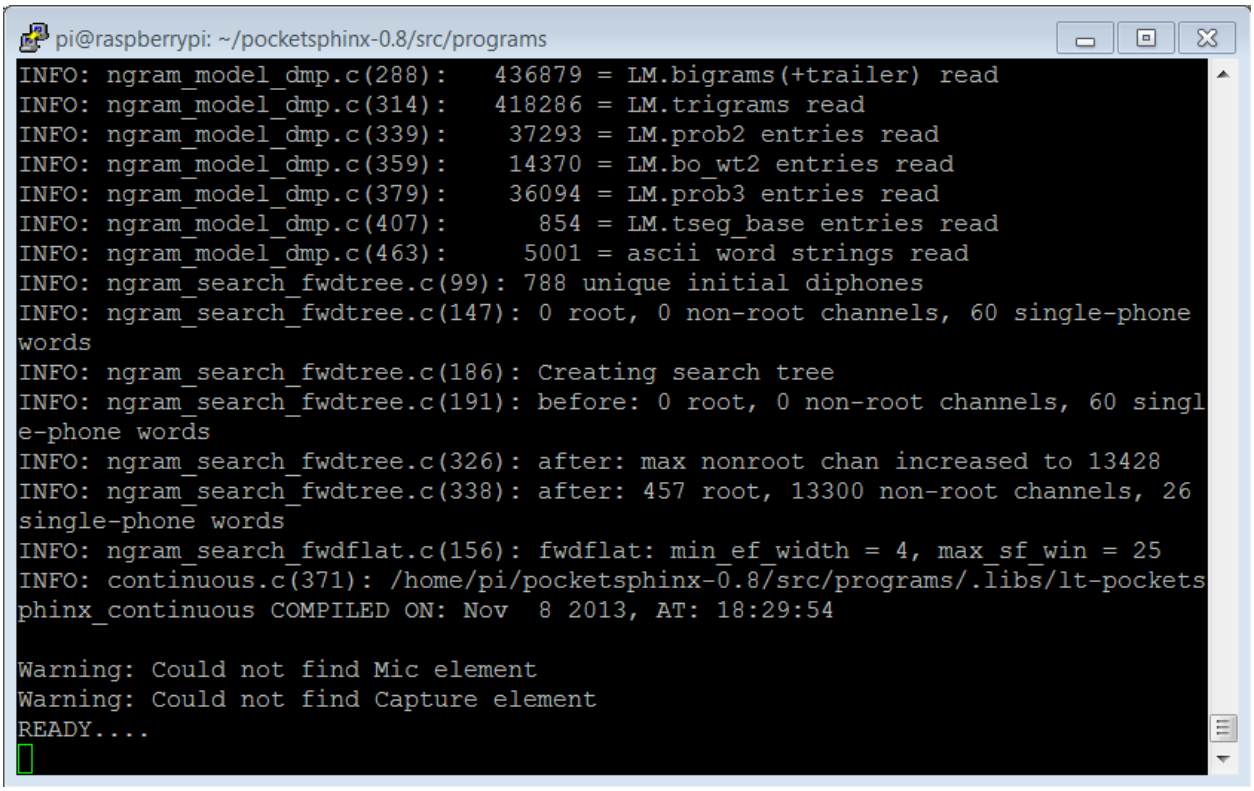

pi@raspberrypi: ~
pi@raspberrypi ~ $ aplay Dance.wav
Playing WAVE 'Dance.wav' : Signed 16 bit Little Endian, Rate 44100 Hz, Stereo
pi@raspberrypi ~ $

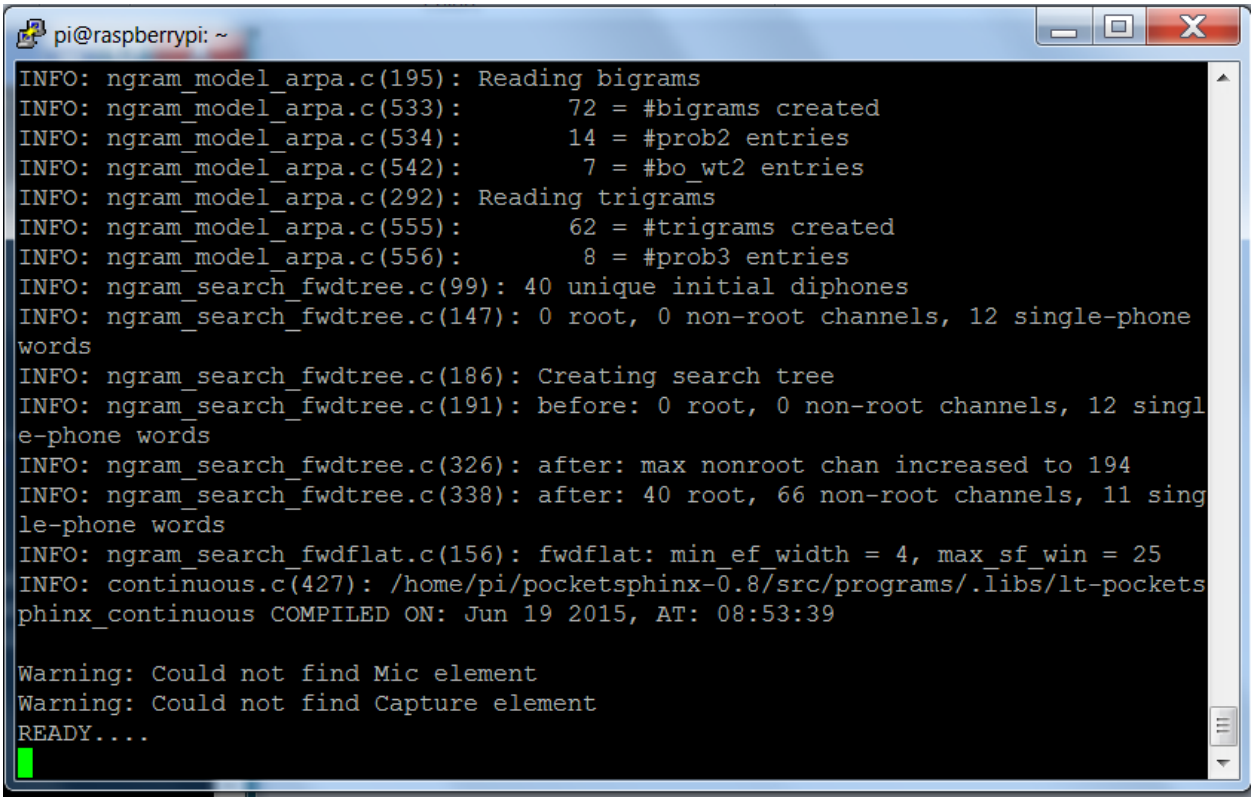

pi@raspberrypi: ~
pi@raspberrypi ~ $ aplay Dance.wav
Playing WAVE 'Dance.wav' : Signed 16 bit Little Endian, Rate 44100 Hz, Stereo
pi@raspberrypi ~ $ arecord -d 5 -r 48000 test.wav
Recording WAVE 'test.wav' : Unsigned 8 bit, Rate 48000 Hz, Mono
pi@raspberrypi ~ $

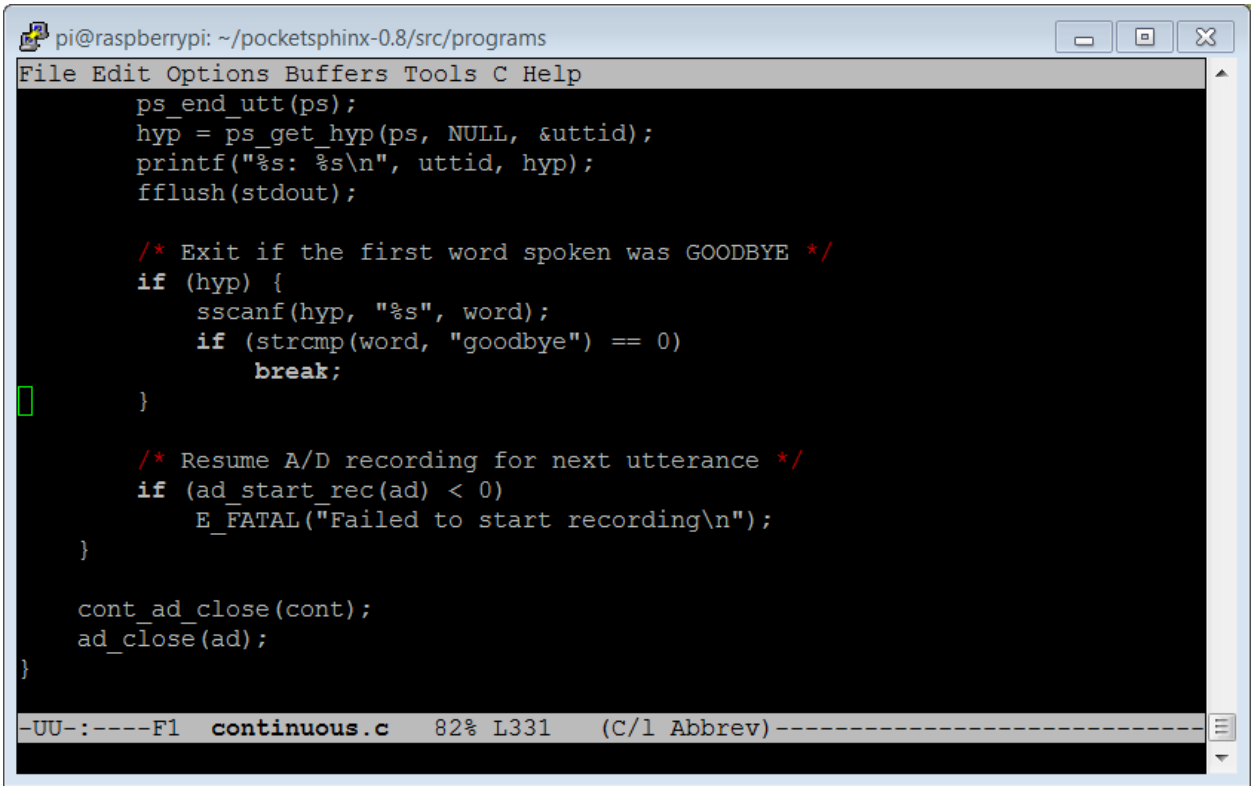

pi@raspberrypi: ~
pi@raspberrypi ~ $ ls
Dance.wav ocr_pi.png python_games test.wav
Desktop pocketsphinx-0.8.tar.gz sphinxbase-0.8.tar.gz
pi@raspberrypi ~ $

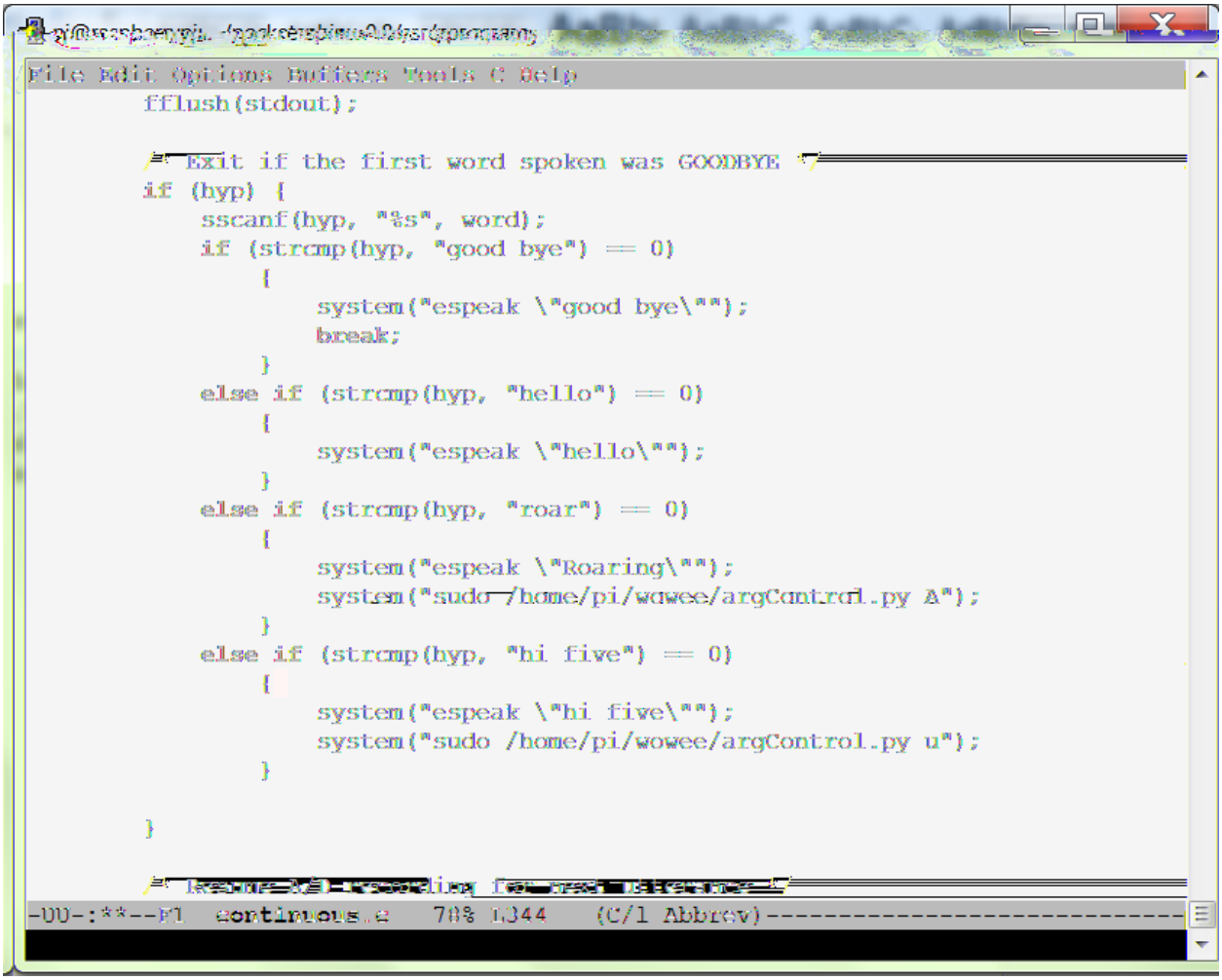

pi@raspberrypi: ~/sphinxbase-0.8
Linux raspberrypi 3.18.11-v7+ #781 SMP PREEMPT Tue Apr 21 18:07:59 BST 2015 armv
71
The programs included with the Debian GNU/Linux system are free software;
the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*/copyright.
Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent
permitted by applicable law.
Last login: Fri Jun 19 20:18:11 2015 from grimmettr.c.byui.edu
pi@raspberrypi ~ $ ls
Dance.wav pocketsphinx-0.8 sketchbook start.sh
Desktop pocketsphinx-0.8.tar.gz sphinxbase-0.8 wowee
hostapd.zip python_games sphinxbase-0.8.tar.gz
pi@raspberrypi ~ $ cd sphinxbase-0.8/
pi@raspberrypi ~/sphinxbase-0.8 $ ls
aclocal.m4 config.status group Makefile sphinxbase.pc
AUTHORS config.sub include Makefile.am sphinxbase.pc.in
autogen.sh configure INSTALL Makefile.in sphinxbase.sln
ChangeLog configure.in install-sh missing src
config.guess COPYING libtool NEWS test
config.log depcomp ltmain.sh python win32
config.rpath doc m4 README ylwrap
pi@raspberrypi ~/sphinxbase-0.8 $


pi@raspberrypi: ~
File Edit Options Buffers Tools Conf Help
include /etc/ld.so.conf.d/*.conf
/usr/local/lib

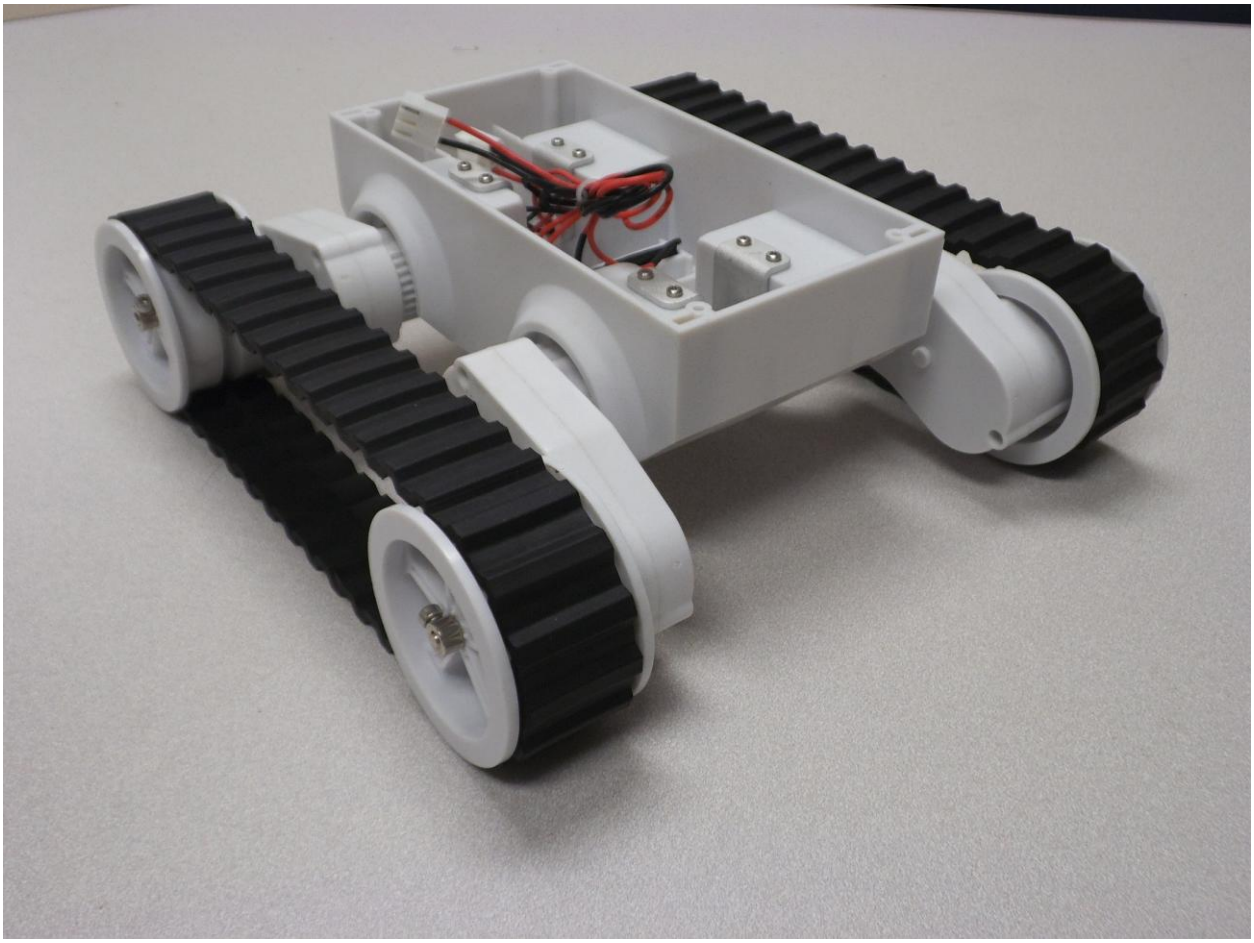

pi@raspberrypi: ~/pocketsphinx-0.8/src/programs
INFO: ngram_model_dmp.c(288):   436879 = LM.bigrams(+trailer) read
INFO: ngram_model_dmp.c(314):   418286 = LM.trigrams read
INFO: ngram_model_dmp.c(339):   37293 = LM.prob2 entries read
INFO: ngram_model_dmp.c(359):   14370 = LM.bo_wt2 entries read
INFO: ngram_model_dmp.c(379):   36094 = LM.prob3 entries read
INFO: ngram_model_dmp.c(407):   854 = LM.tseg_base entries read
INFO: ngram_model_dmp.c(463):   5001 = ascii word strings read
INFO: ngram_search_fwdtree.c(99): 788 unique initial diphones
INFO: ngram_search_fwdtree.c(147): 0 root, 0 non-root channels, 60 single-phone words
INFO: ngram_search_fwdtree.c(186): Creating search tree
INFO: ngram_search_fwdtree.c(191): before: 0 root, 0 non-root channels, 60 single-phone words
INFO: ngram_search_fwdtree.c(326): after: max nonroot chan increased to 13428
INFO: ngram_search_fwdtree.c(338): after: 457 root, 13300 non-root channels, 26 single-phone words
INFO: ngram_search_fwdflat.c(156): fwdflat: min_ef_width = 4, max_sf_win = 25
INFO: continuous.c(371): /home/pi/pocketsphinx-0.8/src/programs/.libs/lt-pocketsphinx_continuous COMPILED ON: Nov 8 2013, AT: 18:29:54
Warning: Could not find Mic element
Warning: Could not find Capture element
READY....

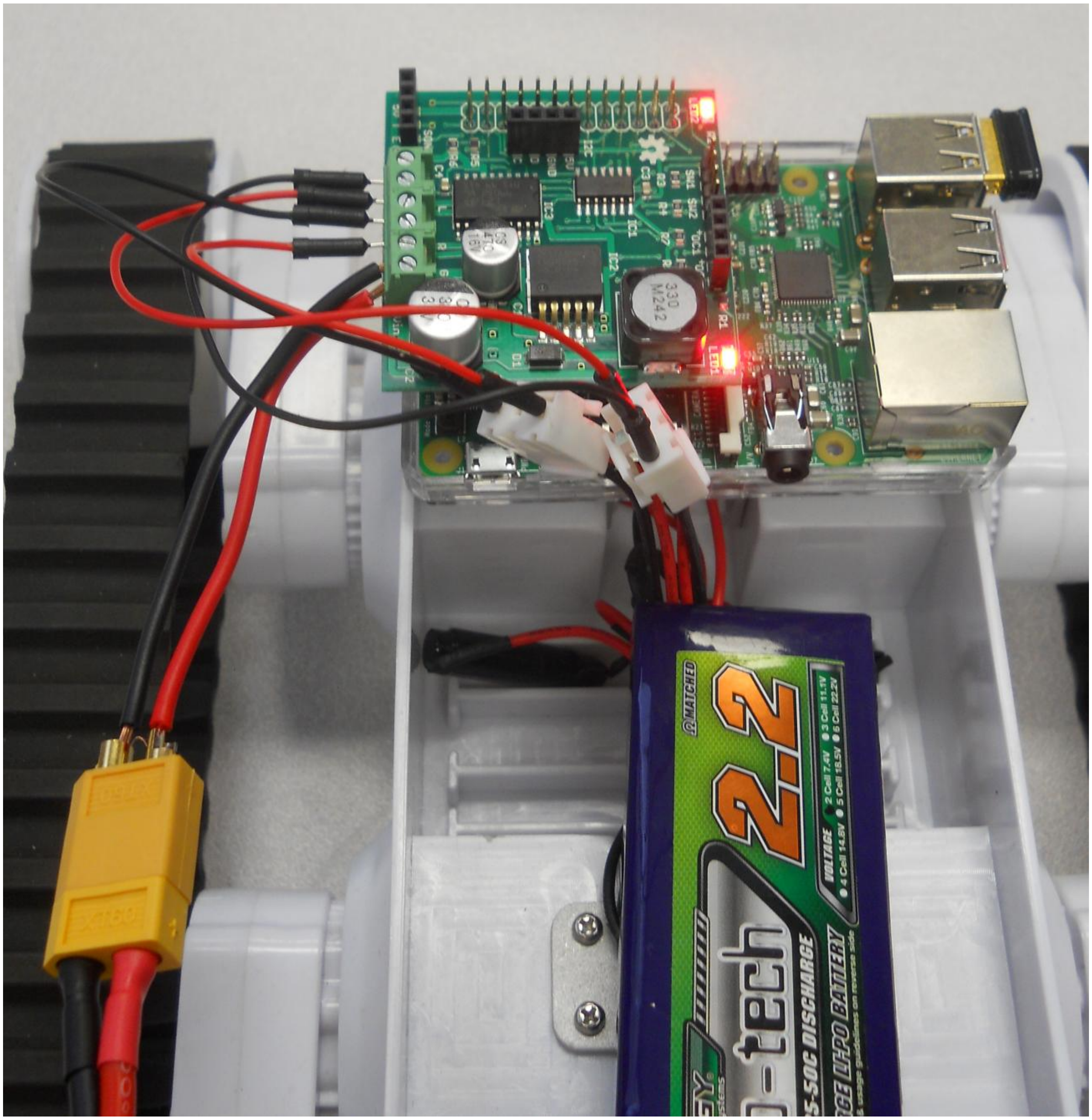

pi@raspberrypi: ~
INFO: ngram_model_arpa.c(195): Reading bigrams
INFO: ngram_model_arpa.c(533):   72 = #bigrams created
INFO: ngram_model_arpa.c(534):   14 = #prob2 entries
INFO: ngram_model_arpa.c(542):   7 = #bo_wt2 entries
INFO: ngram_model_arpa.c(292): Reading trigrams
INFO: ngram_model_arpa.c(555):   62 = #trigrams created
INFO: ngram_model_arpa.c(556):   8 = #prob3 entries
INFO: ngram_search_fwdtree.c(99): 40 unique initial diphones
INFO: ngram_search_fwdtree.c(147): 0 root, 0 non-root channels, 12 single-phone words
INFO: ngram_search_fwdtree.c(186): Creating search tree
INFO: ngram_search_fwdtree.c(191): before: 0 root, 0 non-root channels, 12 single-phone words
INFO: ngram_search_fwdtree.c(326): after: max nonroot chan increased to 194
INFO: ngram_search_fwdtree.c(338): after: 40 root, 66 non-root channels, 11 single-phone words
INFO: ngram_search_fwdflat.c(156): fwdflat: min_ef_width = 4, max_sf_win = 25
INFO: continuous.c(427): /home/pi/pocketsphinx-0.8/src/programs/.libs/lt-pocketsphinx_continuous COMPILED ON: Jun 19 2015, AT: 08:53:39
Warning: Could not find Mic element
Warning: Could not find Capture element
READY....

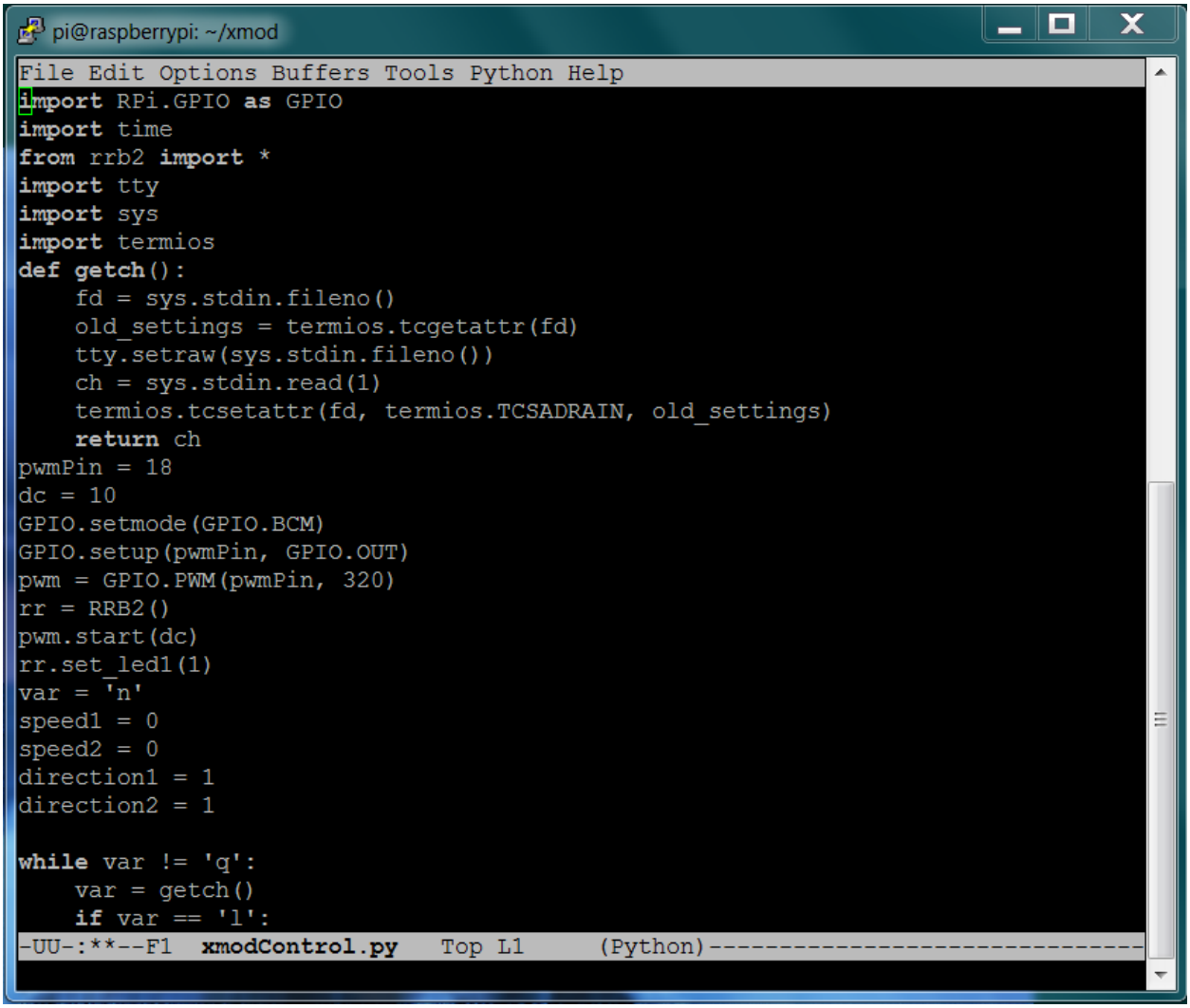

pi@raspberrypi: ~/pocketsphinx-0.8/src/programs
File Edit Options Buffers Tools C Help
ps_end_utt(ps);
hyp = ps_get_hyp(ps, NULL, &uttid);
printf("%s: %s\n", uttid, hyp);
fflush(stdout);
/* Exit if the first word spoken was GOODBYE */
if (hyp) {
sscanf(hyp, "%s", word);
if (strcmp(word, "goodbye") == 0)
break;
}
/* Resume A/D recording for next utterance */
if (ad_start_rec(ad) < 0)
E_FATAL("Failed to start recording\n");
}
cont_ad_close(cont);
ad_close(ad);
}
-UU-:----F1 continuous.c 82% L331 (C/l Abbrev)

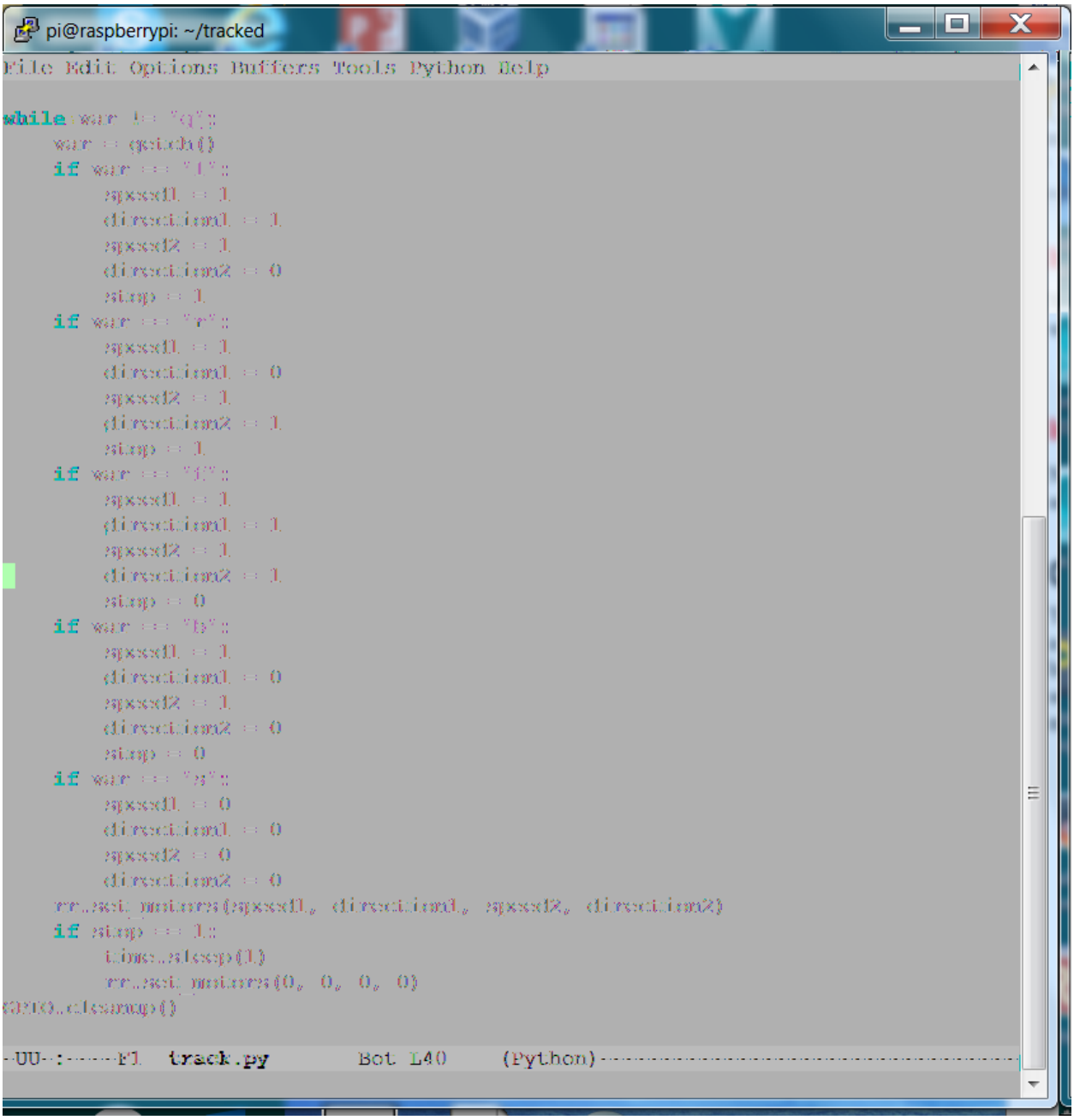

File Edit Options Buffers Tools C Help
fflush(stdout);
/* Exit if the first word spoken was GOODBYE */
if (hyp) {
sscanf(hyp, "%s", word);
if (strcmp(hyp, "good bye") == 0)
{
system("espeak \"good bye\"");
break;
}
else if (strcmp(hyp, "hello") == 0)
{
system("espeak \"hello\"");
}
else if (strcmp(hyp, "roar") == 0)
{
system("espeak \"Roaring\"");
system("sudo /home/pi/wowee/argControl.py A");
}
else if (strcmp(hyp, "hi five") == 0)
{
system("espeak \"hi five\"");
system("sudo /home/pi/wowee/argControl.py u");
}
}
-UU-:**--F1 continuous.c 70% L344 (C/l Abbrev)

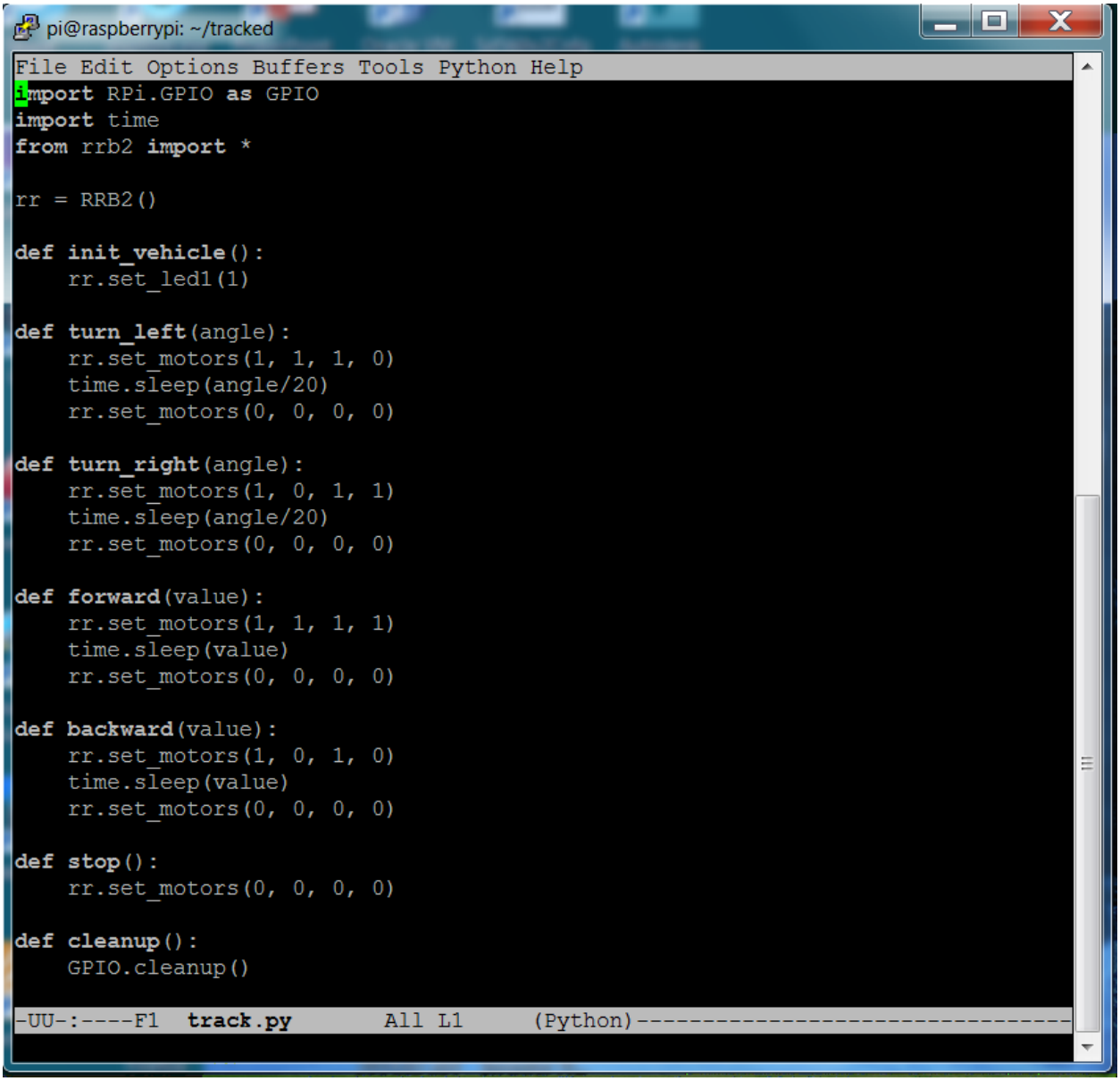
Chapter 3: Building a Tracked Vehicle That Can Plan Its Own Path

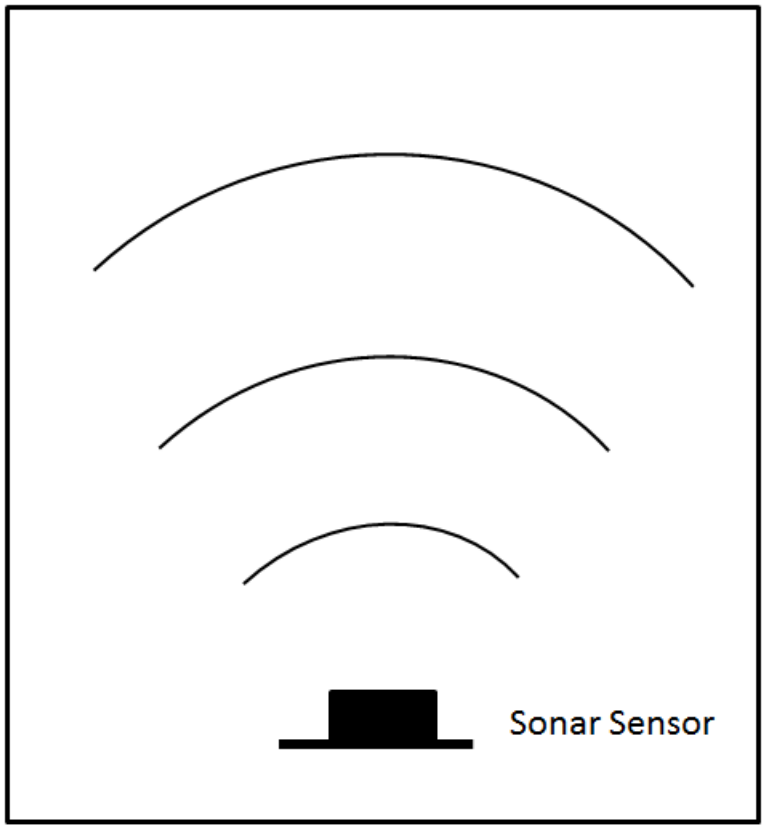


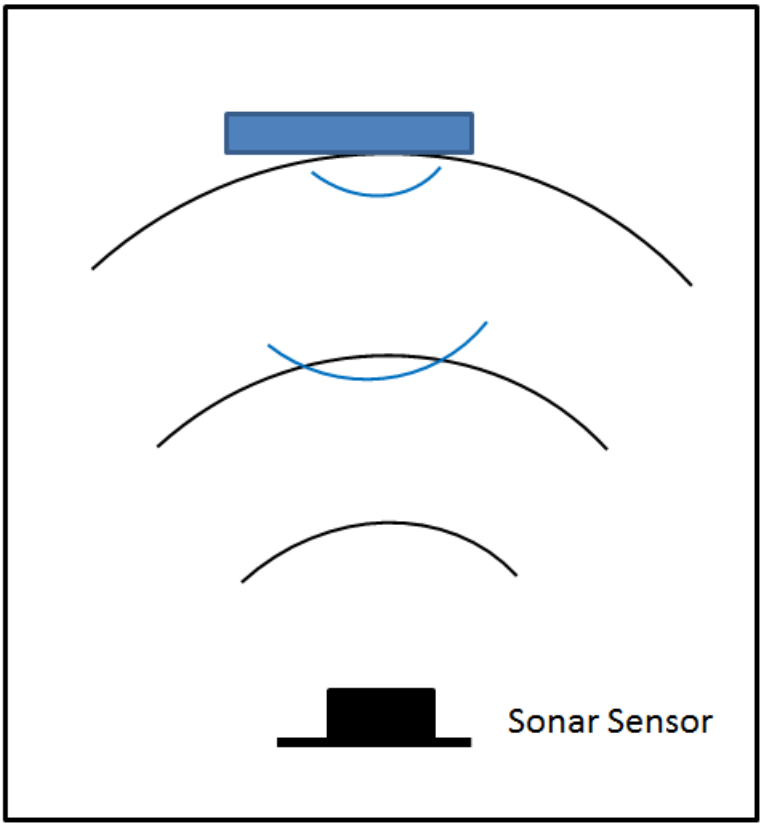

2.2


pi@raspberrypi: ~/xmod
File Edit Options Buffers Tools Python Help
import RPi.GPIO as GPIO
import time
from rrb2 import *
import tty
import sys
import termios
def getch():
fd = sys.stdin.fileno()
old_settings = termios.tcgetattr(fd)
tty.setraw(sys.stdin.fileno())
ch = sys.stdin.read(1)
termios.tcsetattr(fd, termios.TCSADRAIN, old_settings)
return ch
pwmPin = 18
dc = 10
GPIO.setmode(GPIO.BCM)
GPIO.setup(pwmPin, GPIO.OUT)
pwm = GPIO.PWM(pwmPin, 320)
rr = RRB2()
pwm.start(dc)
rr.set_led1(1)
var = 'n'
speed1 = 0
speed2 = 0
direction1 = 1
direction2 = 1
while var != 'q':
var = getch()
if var == 'l':
-UU-:**--F1 xmodControl.py Top L1 (Python)


pi@raspberrypi: ~/tracked
File Edit Options Buffers Tools Python Help
while var != "q":
var = getch()
if var == "l":
xpos1 = 1
direction1 = 1
xpos2 = 1
direction2 = 0
stop = 1
if var == "r":
xpos1 = 1
direction1 = 0
xpos2 = 1
direction2 = 1
stop = 1
if var == "f":
xpos1 = 1
direction1 = 1
xpos2 = 1
direction2 = 1
stop = 0
if var == "b":
xpos1 = 1
direction1 = 0
xpos2 = 1
direction2 = 0
stop = 0
if var == "s":
xpos1 = 0
direction1 = 0
xpos2 = 0
direction2 = 0
rr.set_motors(xpos1, direction1, xpos2, direction2)
if stop == 1:
time.sleep(1)
rr.set_motors(0, 0, 0, 0)
GPIO.cleanup()
-UU-:----F1 track.py Bot L40 (Python)

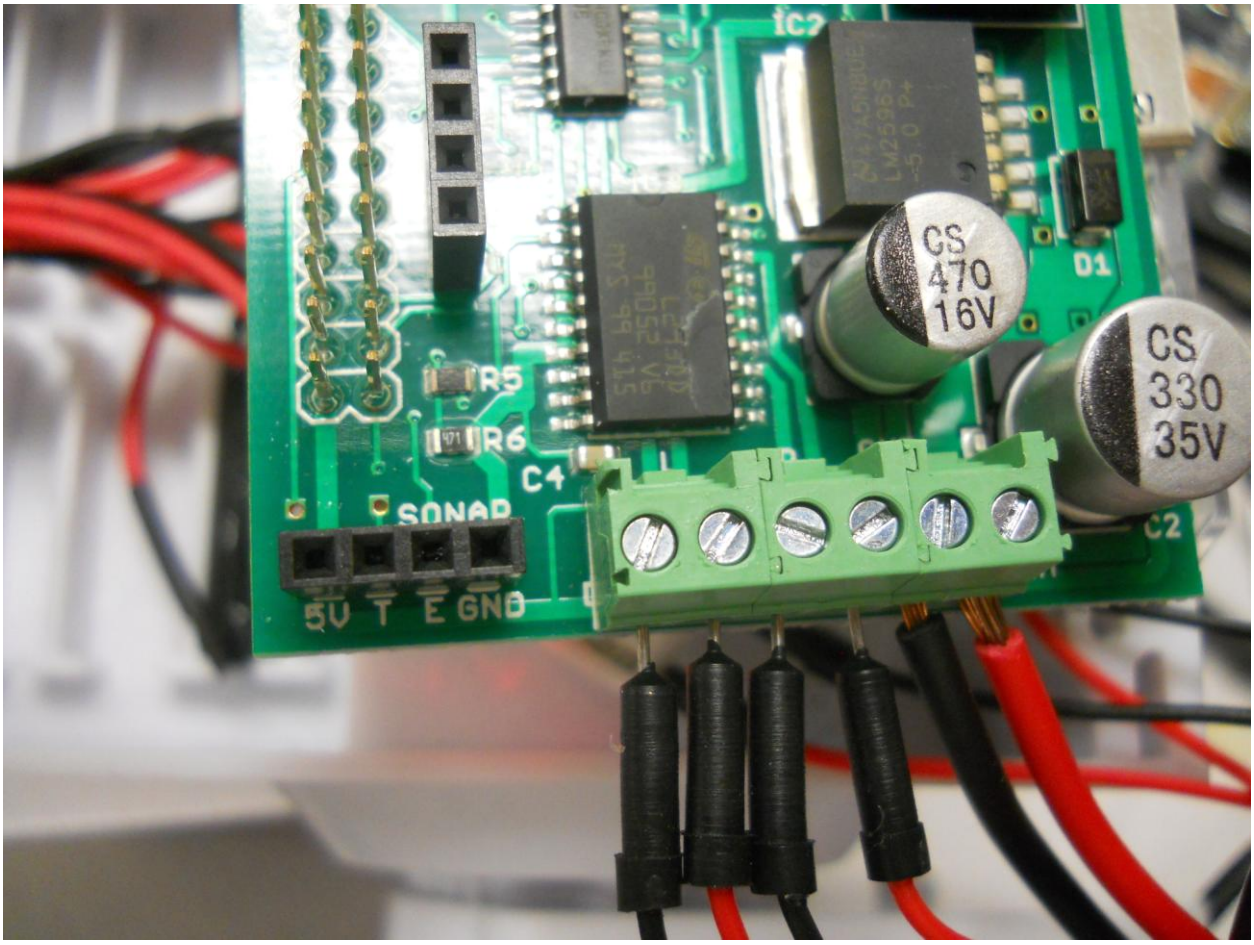

pi@raspberrypi: ~/tracked
File Edit Options Buffers Tools Python Help
import RPi.GPIO as GPIO
import time
from rrb2 import *
rr = RRB2()
def init_vehicle():
rr.set_led1(1)
def turn_left(angle):
rr.set_motors(1, 1, 1, 0)
time.sleep(angle/20)
rr.set_motors(0, 0, 0, 0)
def turn_right(angle):
rr.set_motors(1, 0, 1, 1)
time.sleep(angle/20)
rr.set_motors(0, 0, 0, 0)
def forward(value):
rr.set_motors(1, 1, 1, 1)
time.sleep(value)
rr.set_motors(0, 0, 0, 0)
def backward(value):
rr.set_motors(1, 0, 1, 0)
time.sleep(value)
rr.set_motors(0, 0, 0, 0)
def stop():
rr.set_motors(0, 0, 0, 0)
def cleanup():
GPIO.cleanup()
-UU-:----F1 track.py All L1 (Python)

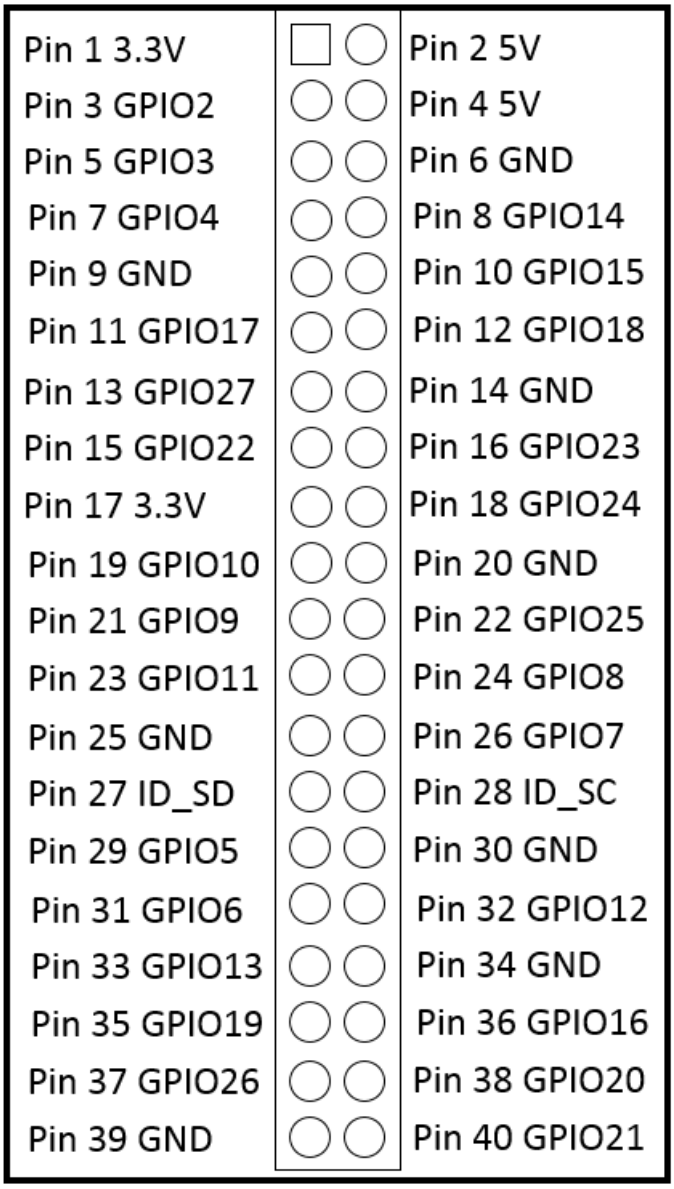

Sonar Sensor

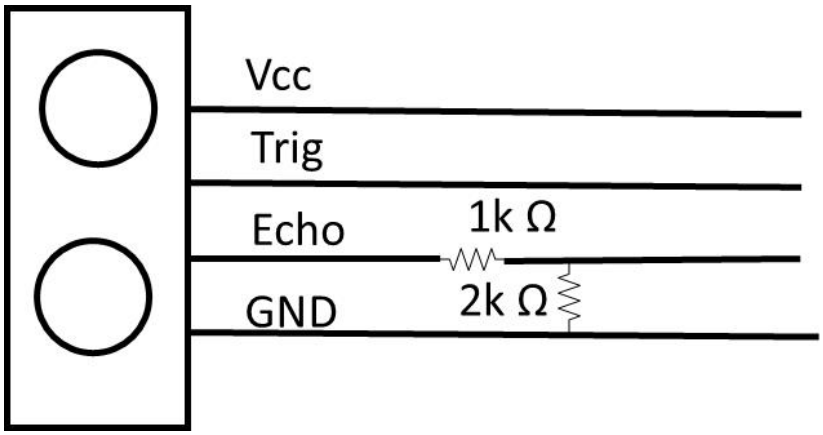

Sonar Sensor

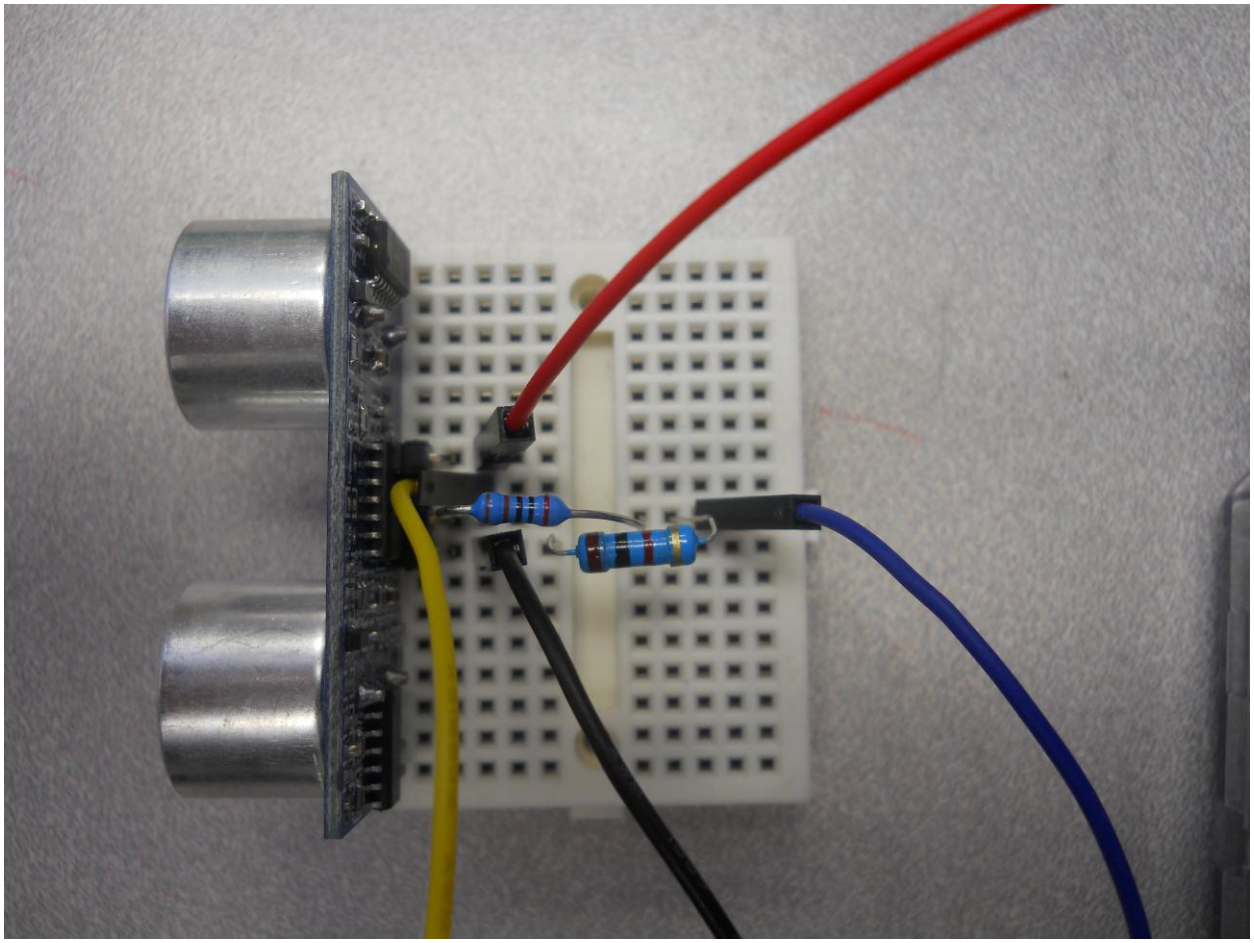

USB-ProxSonar®-EZ™
USB Ultrasonic Proximity Sensor
-Controlled Beam Angle and Detection Zone
-USB interface
-Multi-sensor Operation
MB1414 (5ft.)
MB1424 (3ft.)
MB1434 (2ft.)
MB1444 (1ft.)
MB_____
ProxSonar, MaxBotix, EZ are trademarks of MaxBotix Inc.
Patent 7,679,996
www.maxbotix.com
RoHS

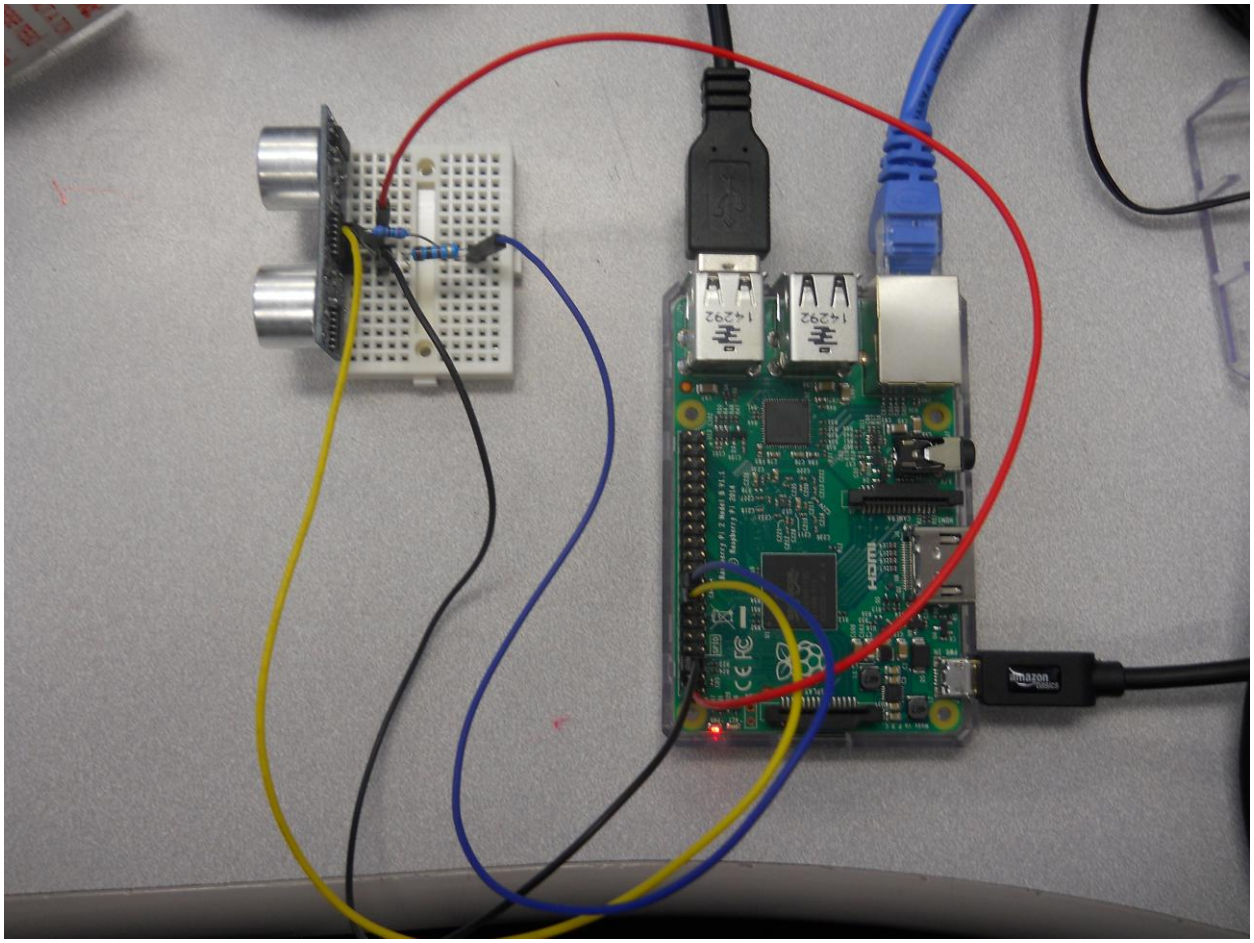

Vcc
Trig
Echo
Gnd

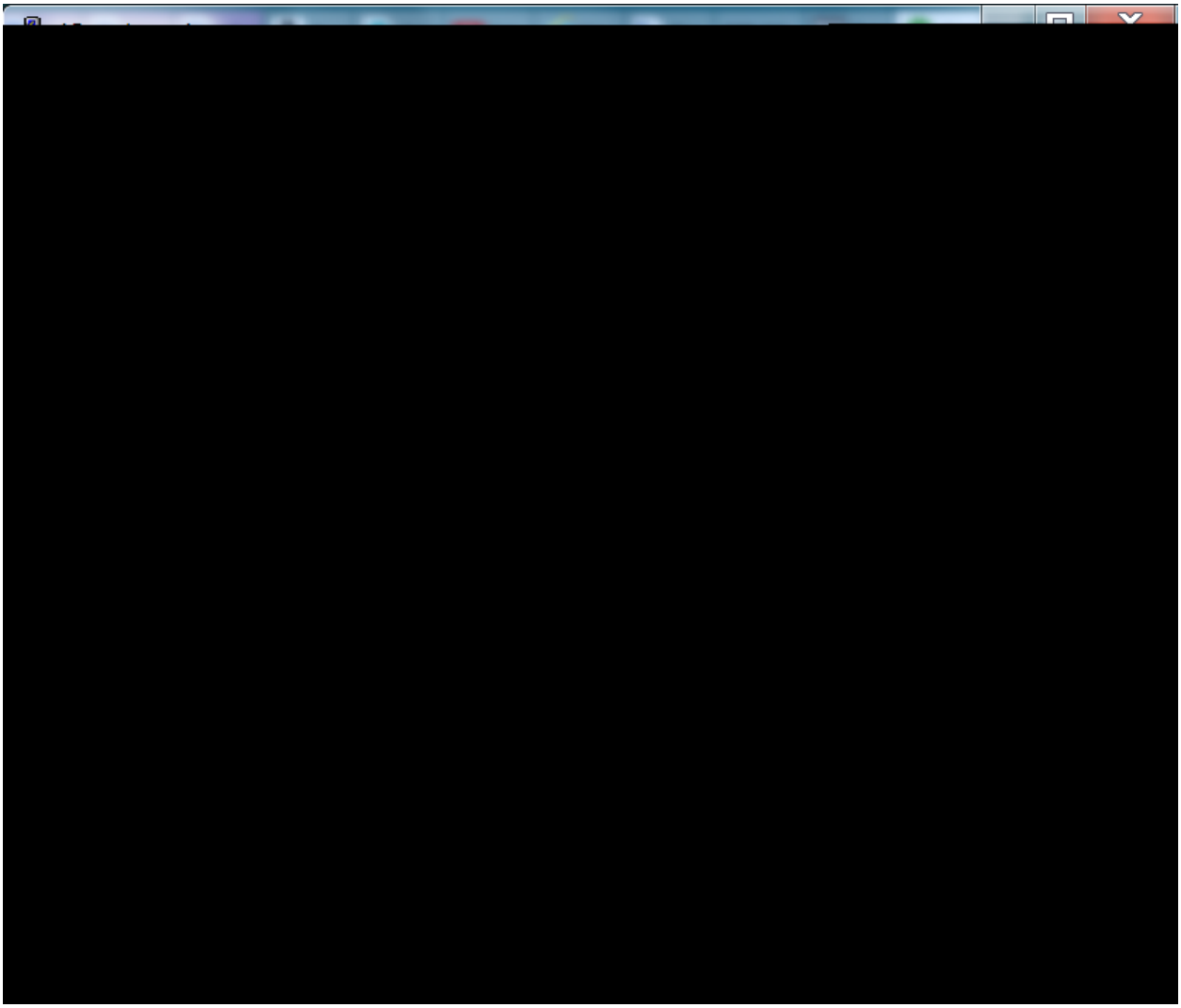

IC2
CS
470
16V
D1
CS
330
35V
R5
R6
C4
SONAR
C2
5V T E GND

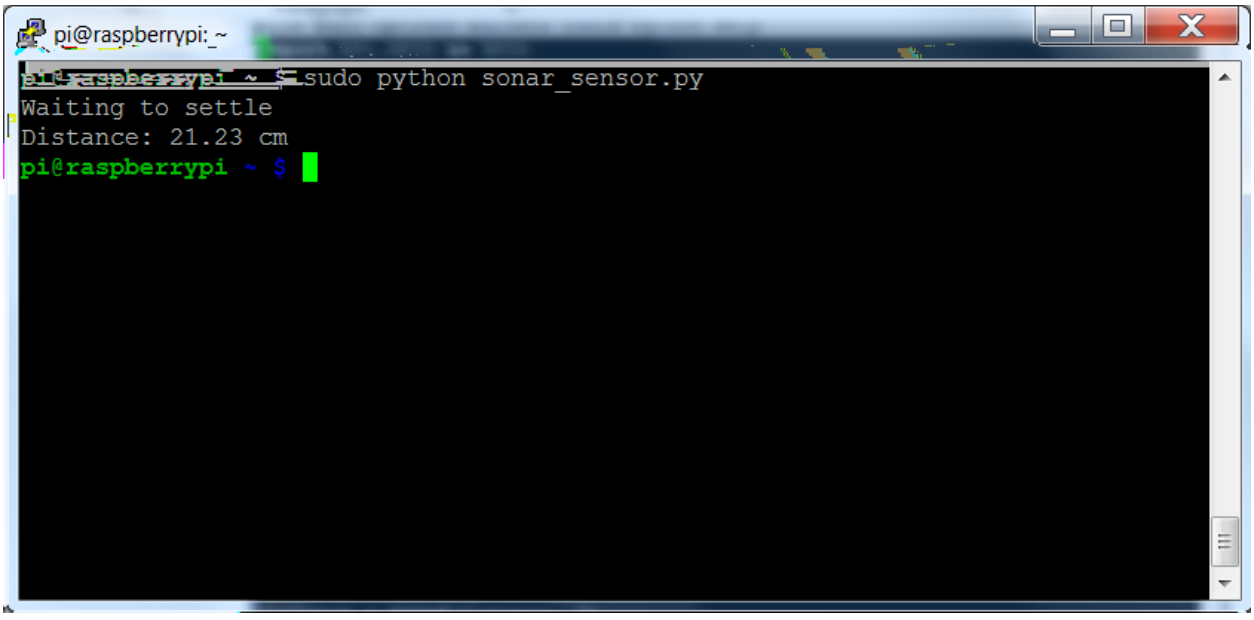

Pin 1 3.3V
Pin 2 5V
Pin 3 GPIO2
Pin 4 5V
Pin 5 GPIO3
Pin 6 GND
Pin 7 GPIO4
Pin 8 GPIO14
Pin 9 GND
Pin 10 GPIO15
Pin 11 GPIO17
Pin 12 GPIO18
Pin 13 GPIO27
Pin 14 GND
Pin 15 GPIO22
Pin 16 GPIO23
Pin 17 3.3V
Pin 18 GPIO24
Pin 19 GPIO10
Pin 20 GND
Pin 21 GPIO9
Pin 22 GPIO25
Pin 23 GPIO11
Pin 24 GPIO8
Pin 25 GND
Pin 26 GPIO7
Pin 27 ID_SD
Pin 28 ID_SC
Pin 29 GPIO5
Pin 30 GND
Pin 31 GPIO6
Pin 32 GPIO12
Pin 33 GPIO13
Pin 34 GND
Pin 35 GPIO19
Pin 36 GPIO16
Pin 37 GPIO26
Pin 38 GPIO20
Pin 39 GND
Pin 40 GPIO21

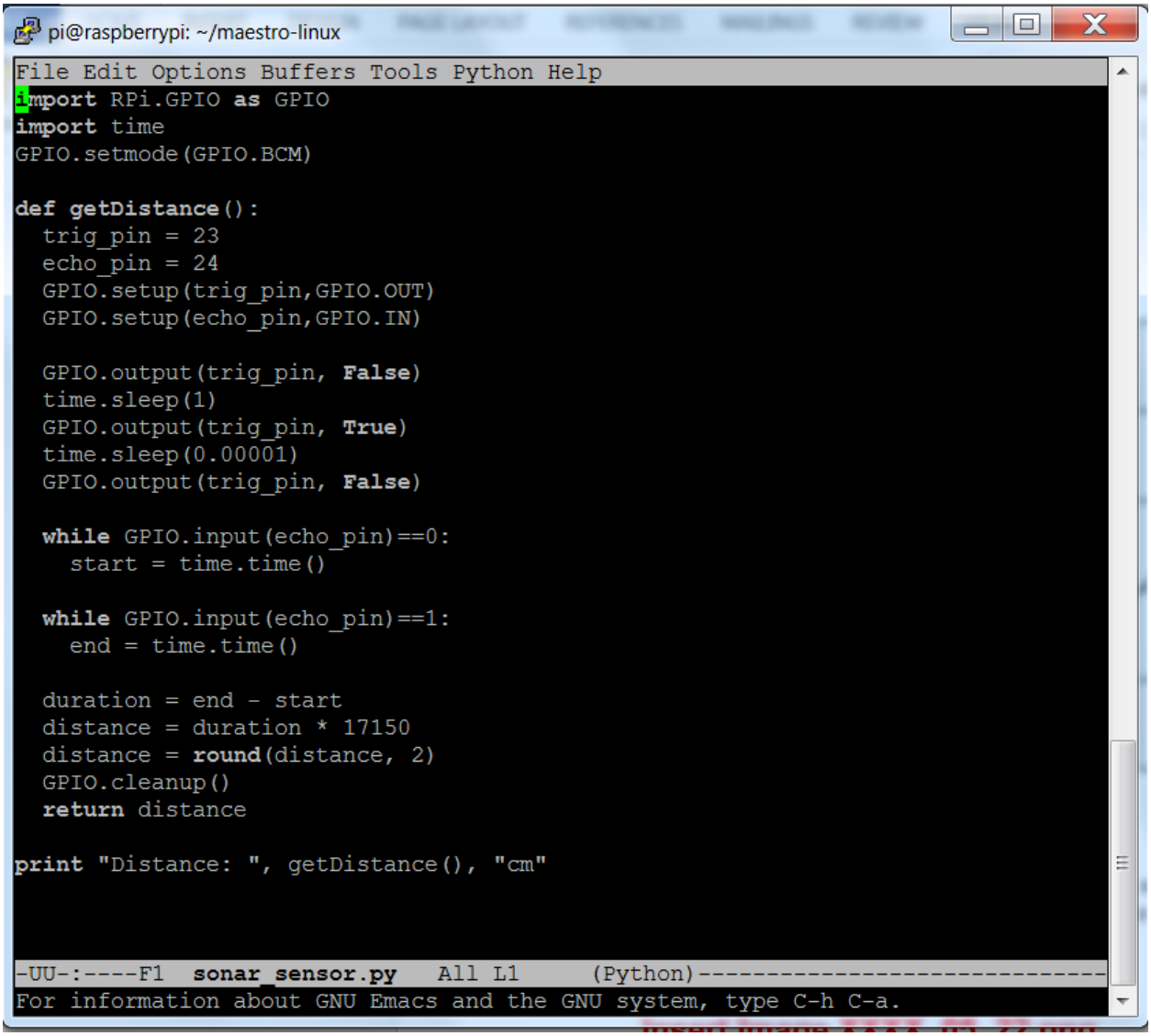

Vcc
Trig
Echo
1k Ω
2k Ω
GND

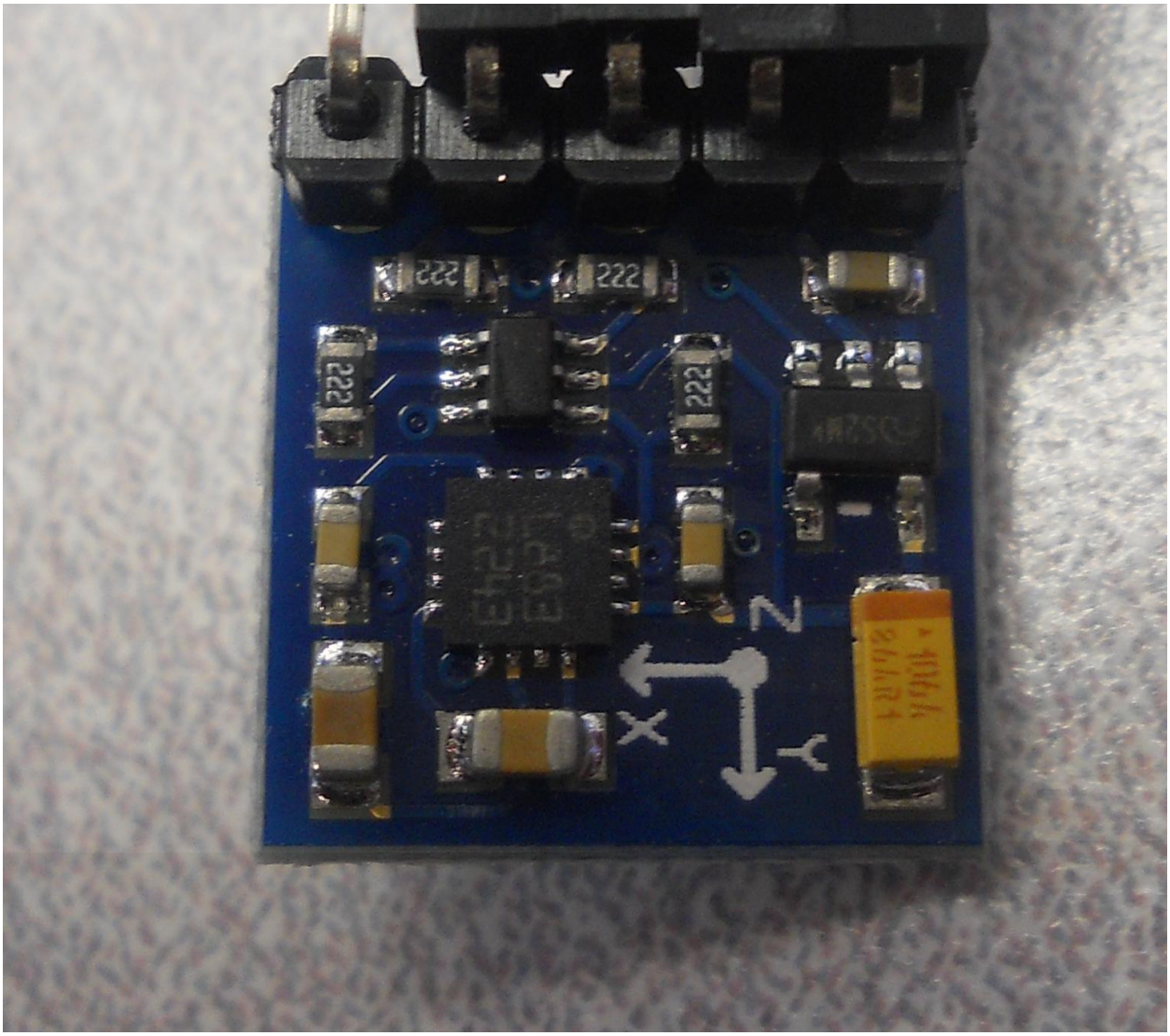


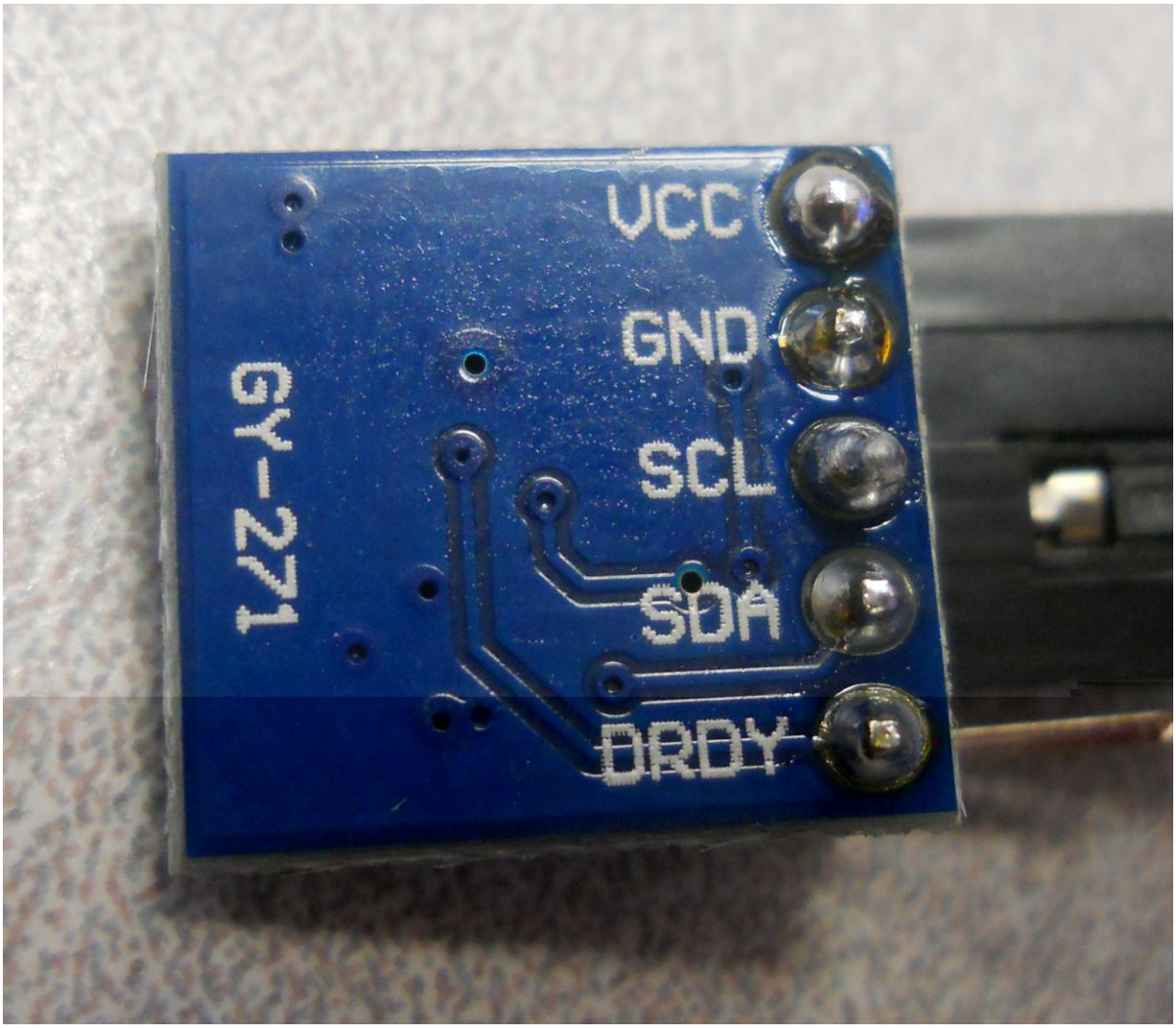


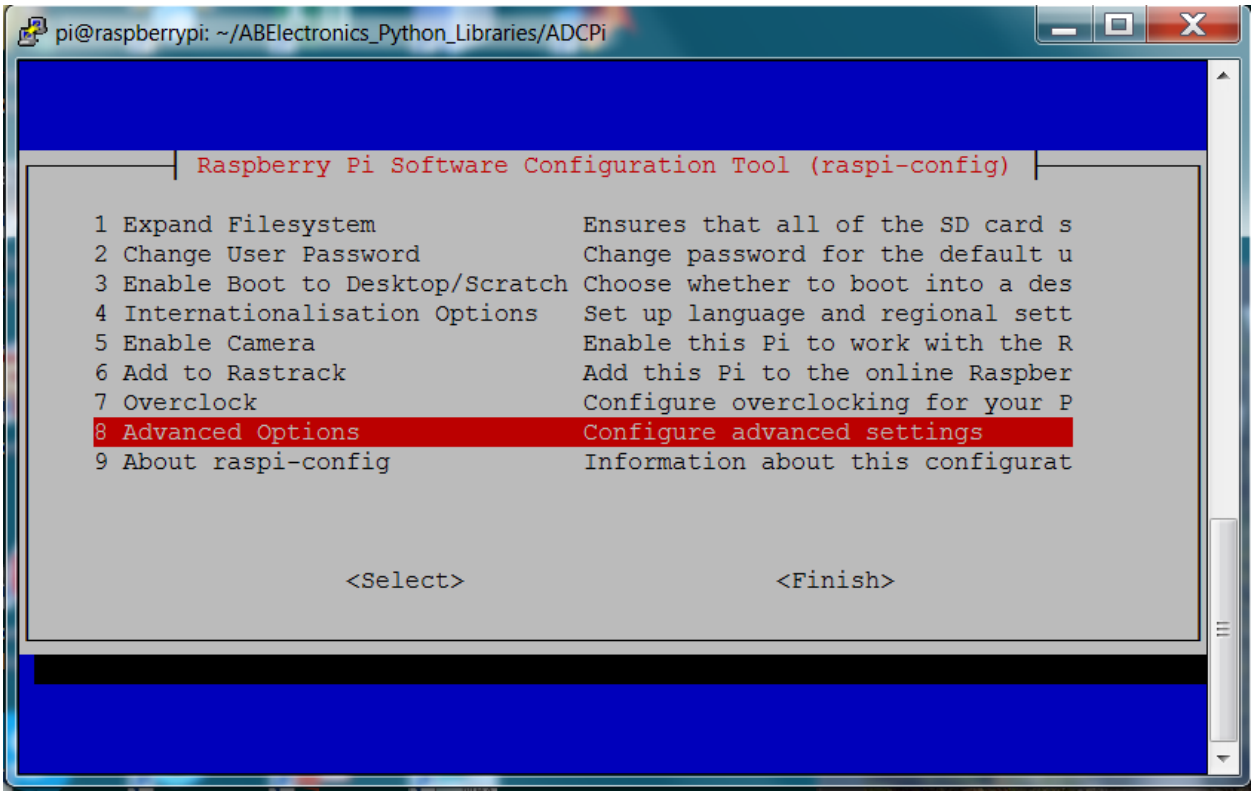


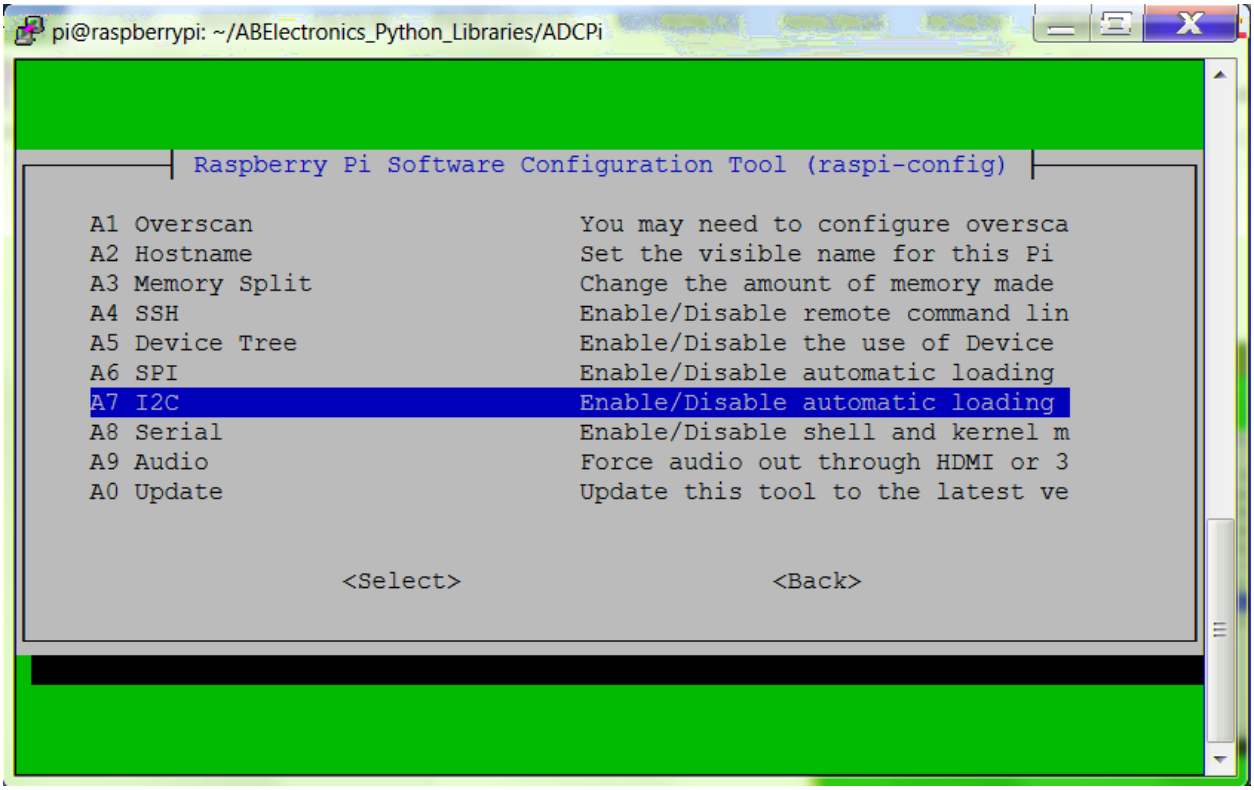

pi@raspberrypi: ~
pi@raspberrypi ~ $ sudo python sonar_sensor.py
Waiting to settle
Distance: 21.23 cm
pi@raspberrypi ~ $

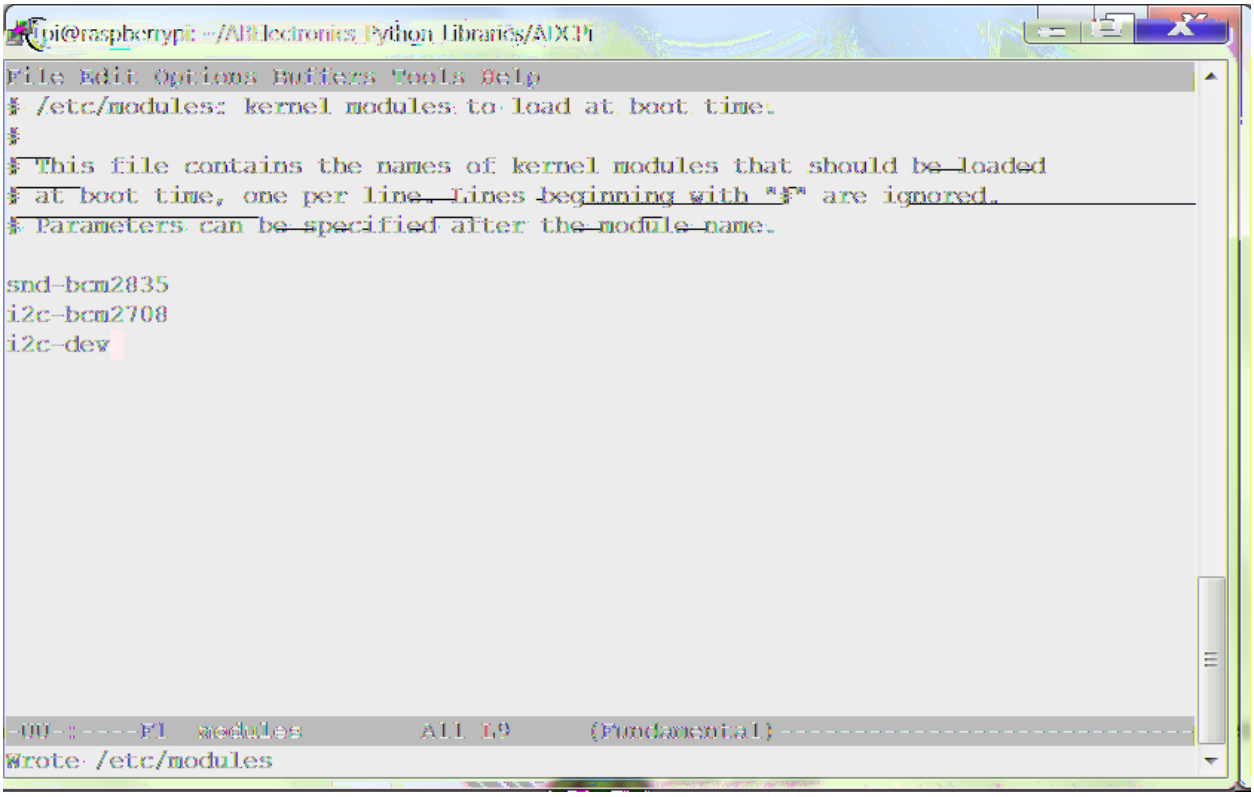

pi@raspberrypi: ~/maestro-linux
File Edit Options Buffers Tools Python Help
import RPi.GPIO as GPIO
import time
GPIO.setmode(GPIO.BCM)
def getDistance():
trig_pin = 23
echo_pin = 24
GPIO.setup(trig_pin,GPIO.OUT)
GPIO.setup(echo_pin,GPIO.IN)
GPIO.output(trig_pin, False)
time.sleep(1)
GPIO.output(trig_pin, True)
time.sleep(0.00001)
GPIO.output(trig_pin, False)
while GPIO.input(echo_pin)==0:
start = time.time()
while GPIO.input(echo_pin)==1:
end = time.time()
duration = end - start
distance = duration * 17150
distance = round(distance, 2)
GPIO.cleanup()
return distance
print "Distance: ", getDistance(), "cm"
-UU-:----F1 sonar_sensor.py All L1 (Python)
For information about GNU Emacs and the GNU system, type C-h C-a.

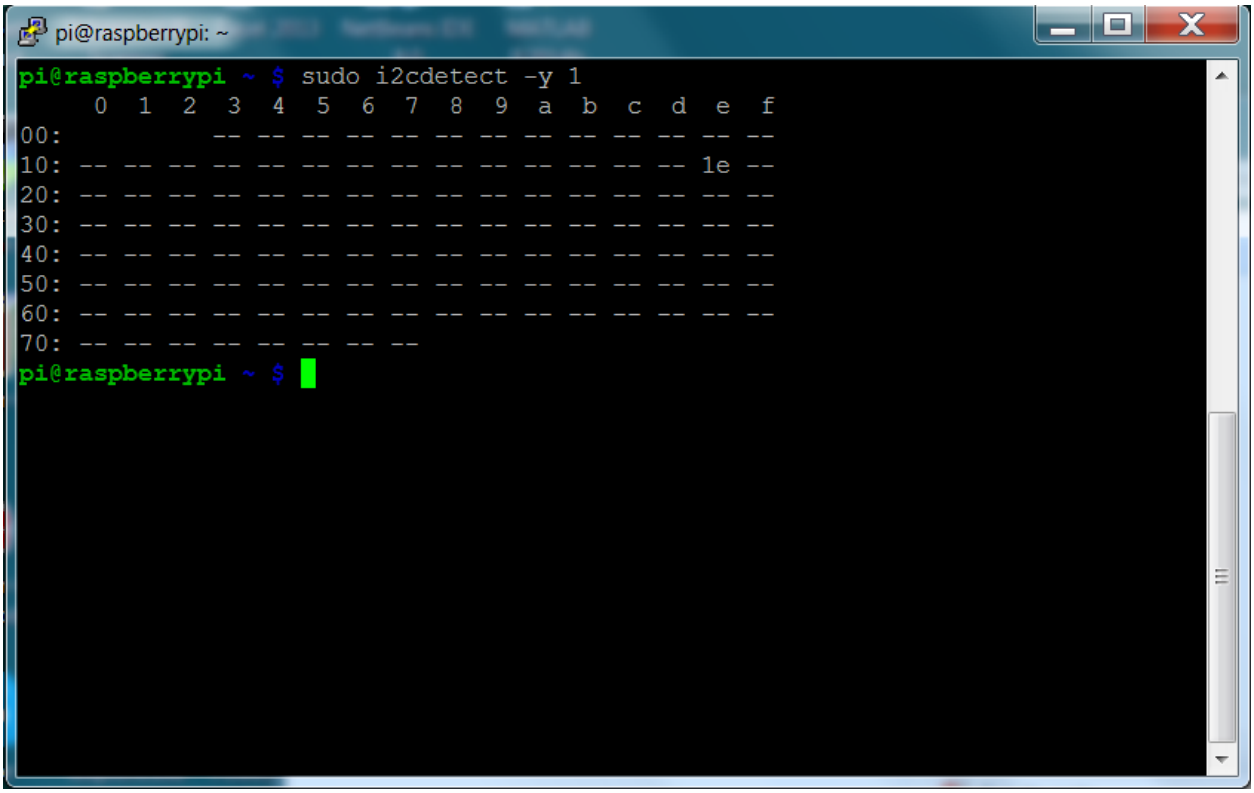

222
222
222
Z
X
Y

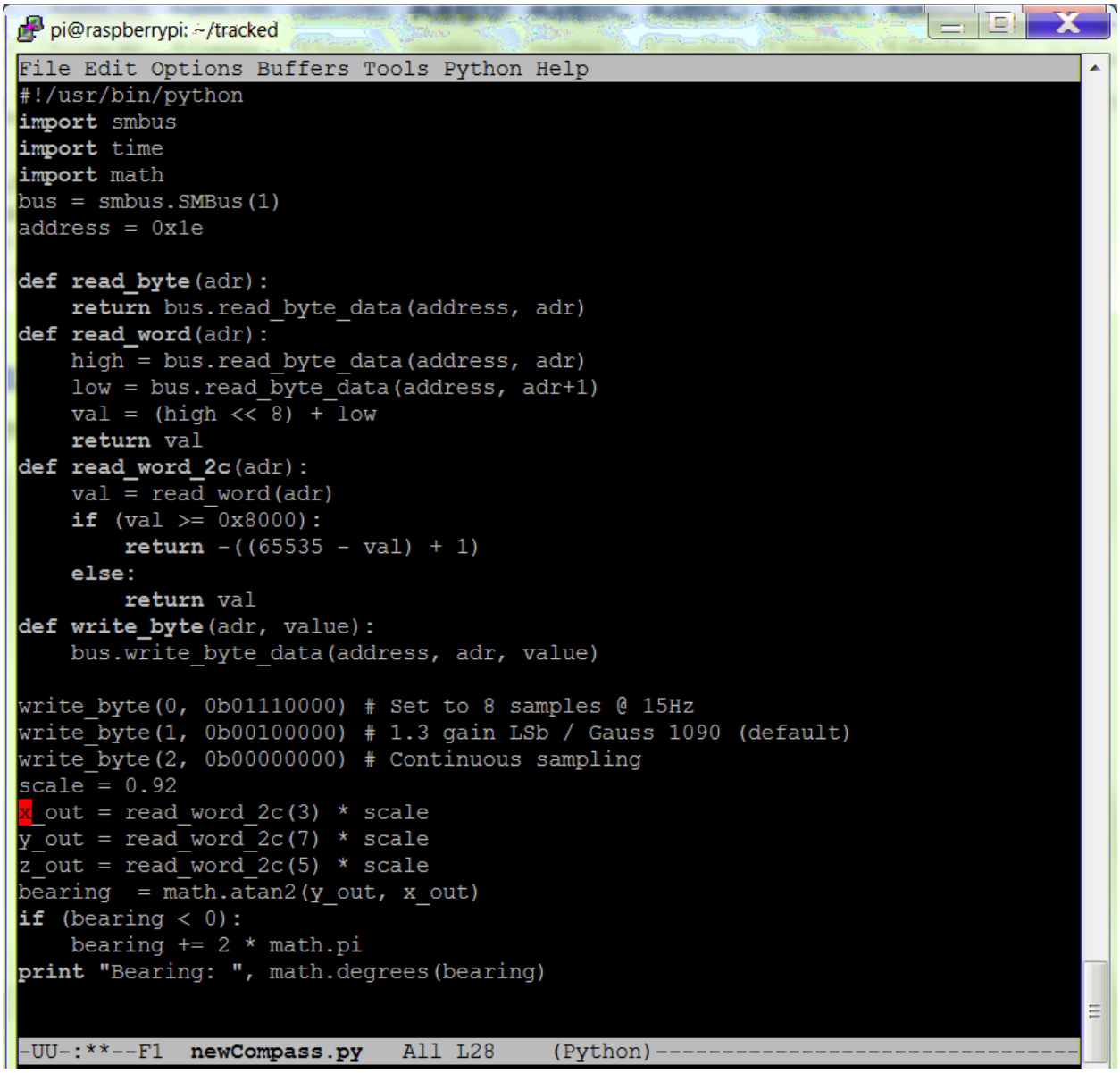

VCC
GND
SCL
SDA
DRDY
GY-271

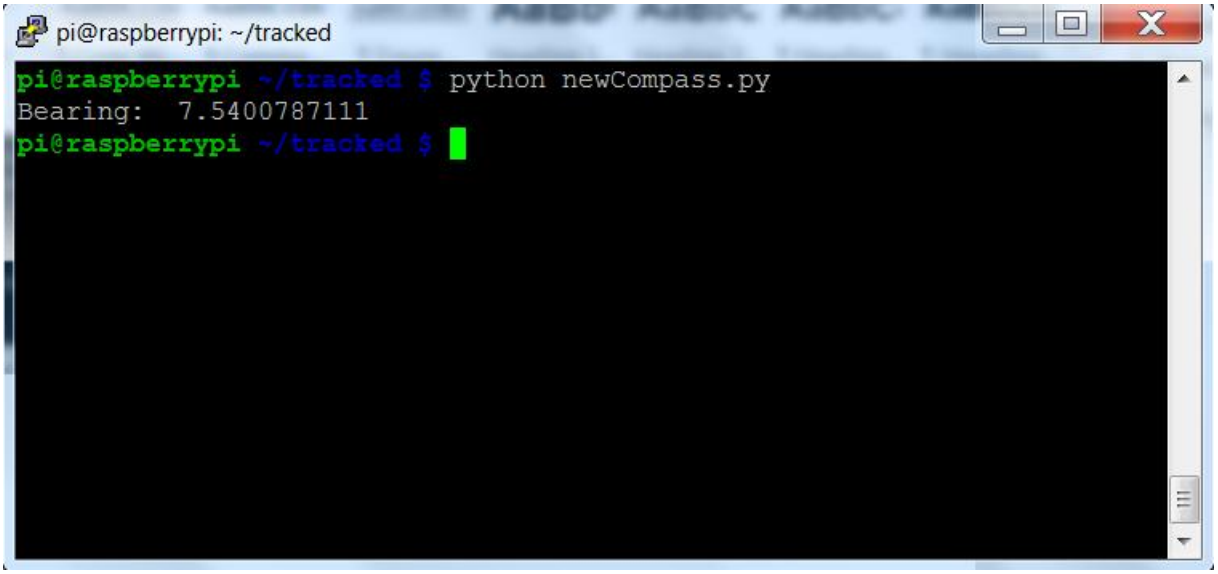

pi@raspberrypi: ~/ABElectronics_Python_Libraries/ADCPi
Raspberry Pi Software Configuration Tool (raspi-config)
1 Expand Filesystem Ensures that all of the SD card s
2 Change User Password Change password for the default u
3 Enable Boot to Desktop/Scratch Choose whether to boot into a des
4 Internationalisation Options Set up language and regional sett
5 Enable Camera Enable this Pi to work with the R
6 Add to Rastrack Add this Pi to the online Raspber
7 Overclock Configure overclocking for your P
8 Advanced Options Configure advanced settings
9 About raspi-config Information about this configurat
<Select>
<Finish>

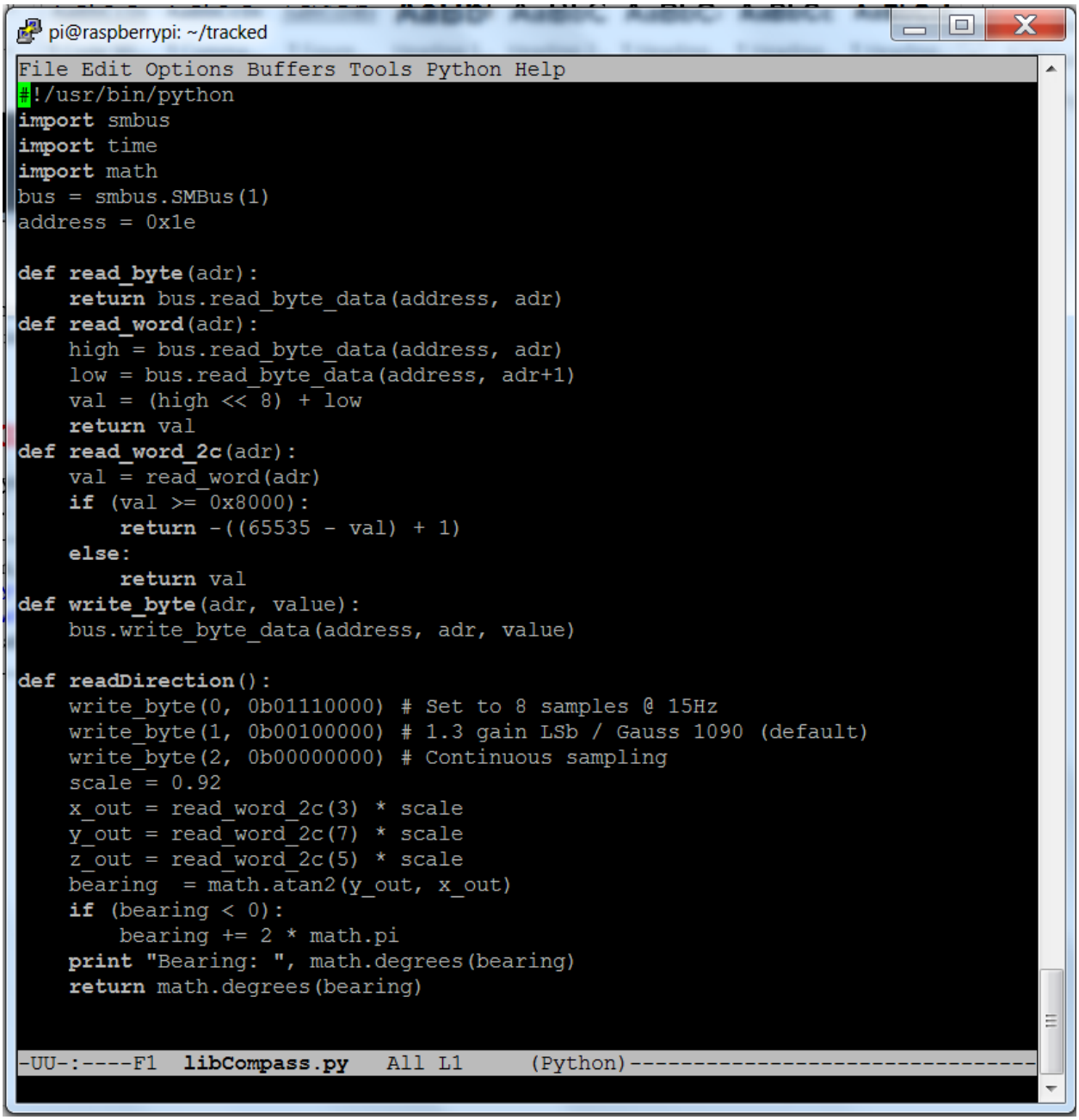

pi@raspberrypi: ~/ABElectronics_Python_Libraries/ADCPi
Raspberry Pi Software Configuration Tool (raspi-config)
A1 Overscan You may need to configure oversca
A2 Hostname Set the visible name for this Pi
A3 Memory Split Change the amount of memory made
A4 SSH Enable/Disable remote command lin
A5 Device Tree Enable/Disable the use of Device
A6 SPI Enable/Disable automatic loading
A7 I2C Enable/Disable automatic loading
A8 Serial Enable/Disable shell and kernel m
A9 Audio Force audio out through HDMI or 3
A0 Update Update this tool to the latest ve
<Select>
<Back>


pi@raspberrypi: ~/ABElectronics Python Libraries/ADCPi
File Edit Options Buffers Tools Help
/etc/modules: kernel modules to load at boot time.
#
This file contains the names of kernel modules that should be loaded
at boot time, one per line. Lines beginning with "#" are ignored.
Parameters can be specified after the module name.
snd-bcm2835
i2c-bcm2708
i2c-dev
-UU-:----F1 modules All L9 (Fundamental)
Wrote /etc/modules


pi@raspberrypi: ~
pi@raspberrypi ~ $ sudo i2cdetect -y 1
0 1 2 3 4 5 6 7 8 9 a b c d e f
00: -- -- -- -- -- -- -- -- -- -- -- -- --
10: -- -- -- -- -- -- -- -- -- -- -- -- -- -- 1e --
20: -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- --
30: -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- --
40: -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- --
50: -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- --
60: -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- --
70: -- -- -- -- -- -- -- --
pi@raspberrypi ~ $


pi@raspberrypi: ~/tracked
File Edit Options Buffers Tools Python Help
#!/usr/bin/python
import smbus
import time
import math
bus = smbus.SMBus(1)
address = 0x1e
def read_byte(adr):
return bus.read_byte_data(address, adr)
def read_word(adr):
high = bus.read_byte_data(address, adr)
low = bus.read_byte_data(address, adr+1)
val = (high << 8) + low
return val
def read_word_2c(adr):
val = read_word(adr)
if (val >= 0x8000):
return -((65535 - val) + 1)
else:
return val
def write_byte(adr, value):
bus.write_byte_data(address, adr, value)
write_byte(0, 0b01110000) # Set to 8 samples @ 15Hz
write_byte(1, 0b00100000) # 1.3 gain LSb / Gauss 1090 (default)
write_byte(2, 0b00000000) # Continuous sampling
scale = 0.92
x_out = read_word_2c(3) * scale
y_out = read_word_2c(7) * scale
z_out = read_word_2c(5) * scale
bearing = math.atan2(y_out, x_out)
if (bearing < 0):
bearing += 2 * math.pi
print "Bearing: ", math.degrees(bearing)
-UU-:**--F1 newCompass.py All L28 (Python)

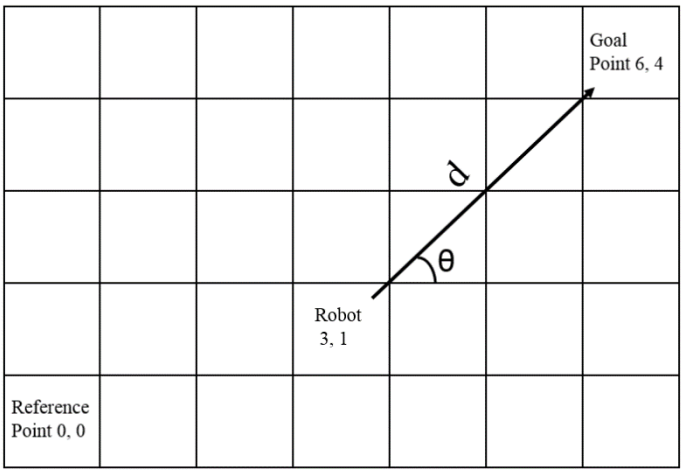

pi@raspberrypi: ~/tracked
pi@raspberrypi ~/tracked $ python newCompass.py
Bearing: 7.5400787111
pi@raspberrypi ~/tracked $


pi@raspberrypi: ~/tracked
File Edit Options Buffers Tools Python Help
#!/usr/bin/python
import smbus
import time
import math
bus = smbus.SMBus(1)
address = 0x1e
def read_byte(adr):
return bus.read_byte_data(address, adr)
def read_word(adr):
high = bus.read_byte_data(address, adr)
low = bus.read_byte_data(address, adr+1)
val = (high << 8) + low
return val
def read_word_2c(adr):
val = read_word(adr)
if (val >= 0x8000):
return -((65535 - val) + 1)
else:
return val
def write_byte(adr, value):
bus.write_byte_data(address, adr, value)
def readDirection():
write_byte(0, 0b01110000) # Set to 8 samples @ 15Hz
write_byte(1, 0b00100000) # 1.3 gain LSb / Gauss 1090 (default)
write_byte(2, 0b00000000) # Continuous sampling
scale = 0.92
x_out = read_word_2c(3) * scale
y_out = read_word_2c(7) * scale
z_out = read_word_2c(5) * scale
bearing = math.atan2(y_out, x_out)
if (bearing < 0):
bearing += 2 * math.pi
print "Bearing: ", math.degrees(bearing)
return math.degrees(bearing)
-UU-:----F1 libCompass.py All L1 (Python)

						Goal Point 6, 4
			Robot 3, 1			
Reference Point 0, 0						

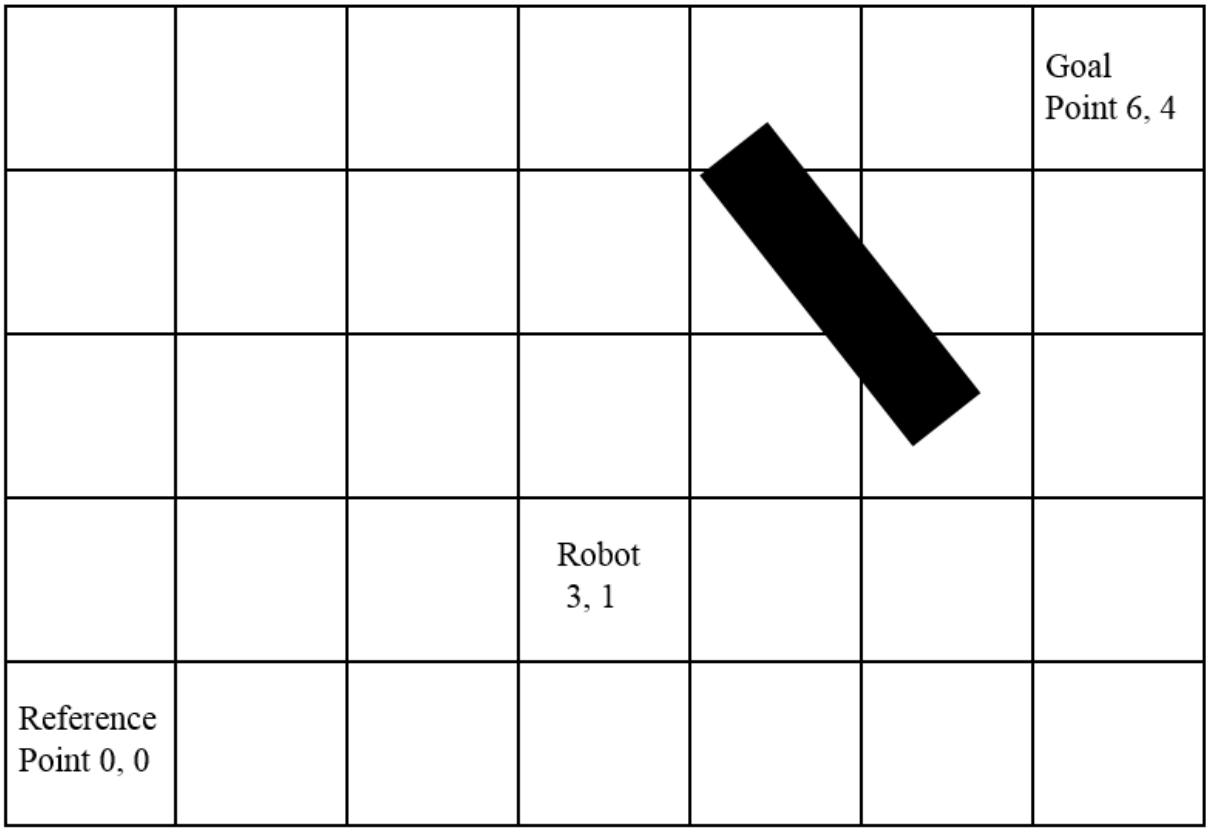
$$d = \sqrt{\left(\left(Xgoal - Xgoal \right)^2 + \left(Ygoal - Yrobot \right)^2 \right)}$$

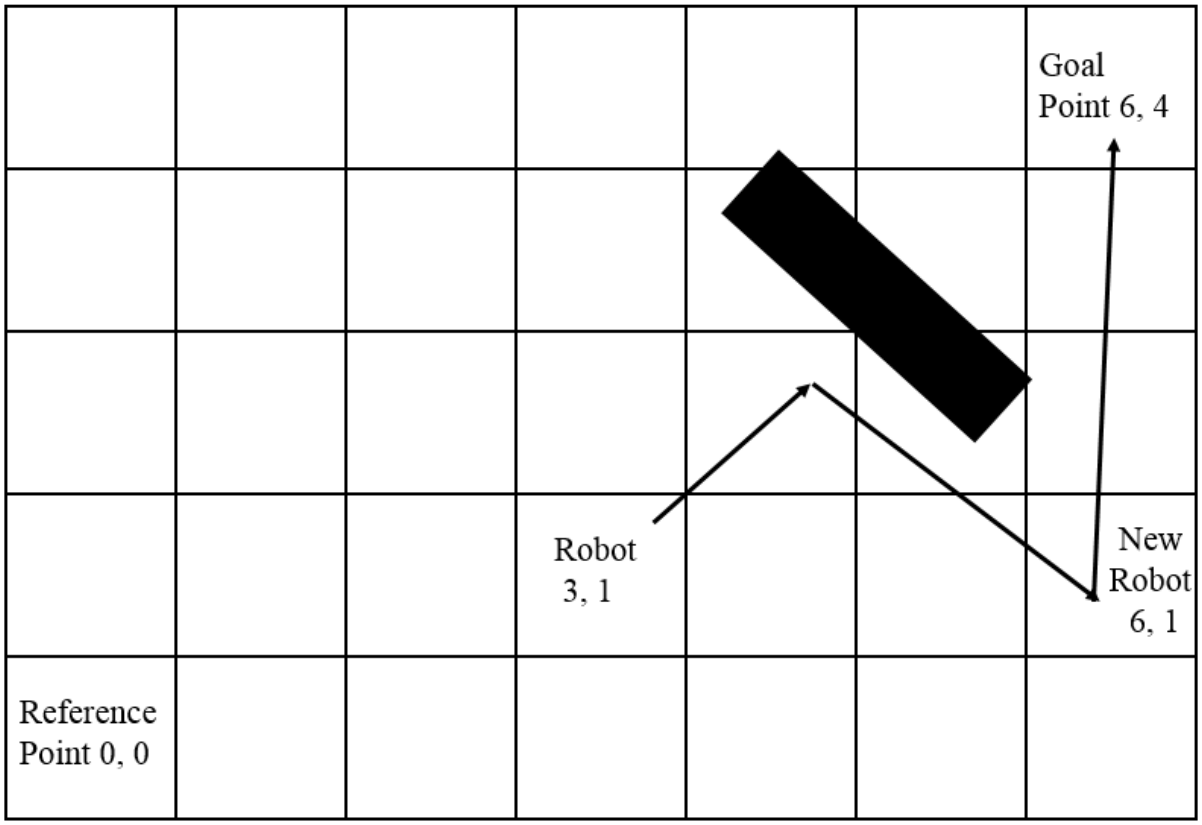
$$\theta = \arctan\left(\frac{Ygoal - Yrobot}{Xgoal - Xrobot} \right)$$

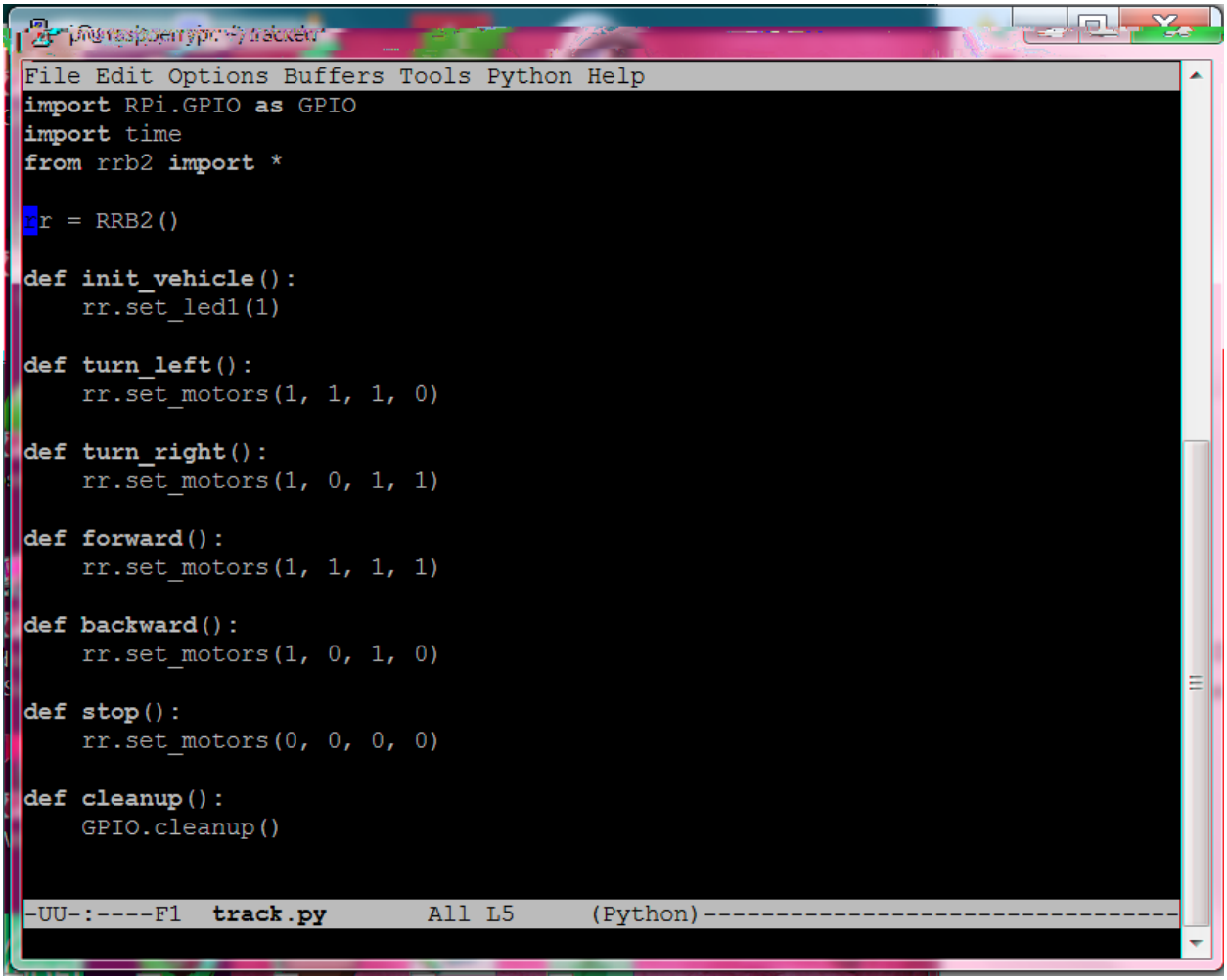


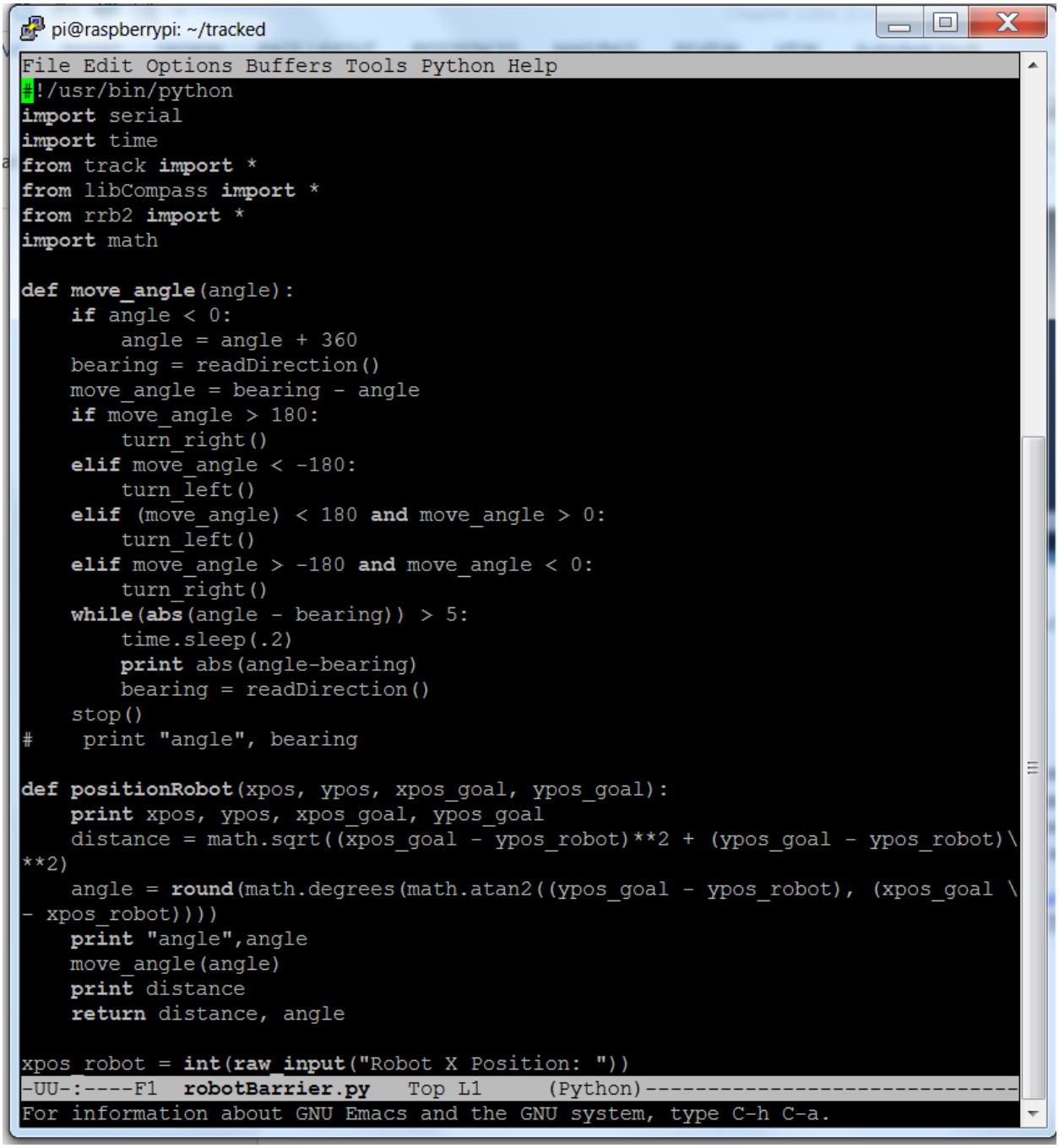
pi@raspberrypi: ~/tracked

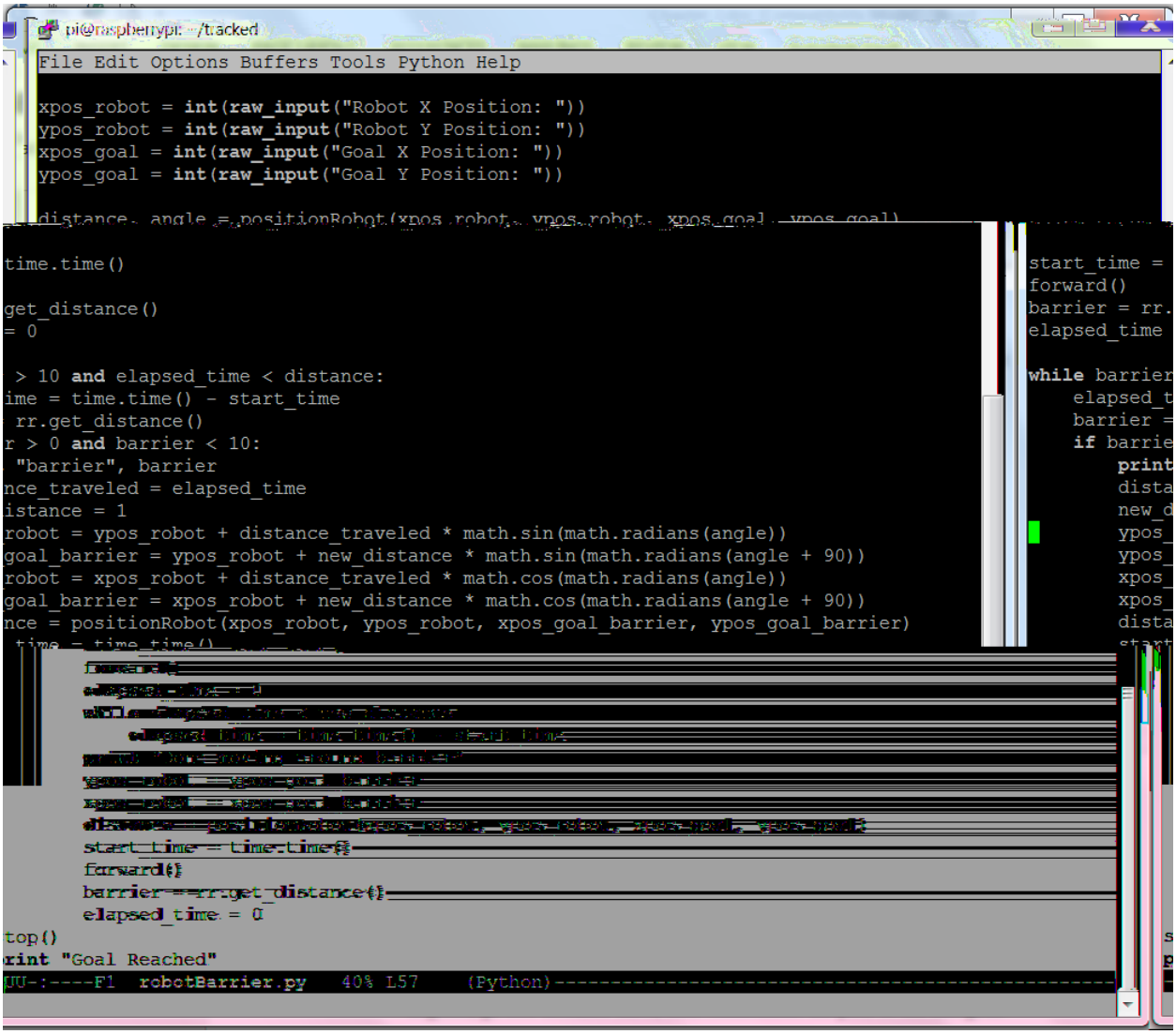
```
File Edit Options Buffers Tools Python Help
#!/usr/bin/python
import time
from track import *
import math

xpos_robot = int(raw_input("Robot X Position: "))
ypos_robot = int(raw_input("Robot Y Position: "))
xpos_goal = int(raw_input("Goal X Position: "))
ypos_goal = int(raw_input("Goal Y Position: "))

distance = math.sqrt((xpos_goal - ypos_robot)**2 + (ypos_goal - ypos_robot)**2)
angle = round(math.degrees(math.atan2((ypos_goal - ypos_robot), (xpos_goal - xpos_robot))))
if angle < 0:
    angle = angle + 360
print (angle)
# Turn to the right bearing
if (angle) < 180:
    turn_right(angle)
else:
    turn_left(angle)
print (distance)
forward(distance)


-UU-:----F1  robotGoal.py    All L1      (Python)----------------------------------------------
For information about GNU Emacs and the GNU system, type C-h C-a.
```



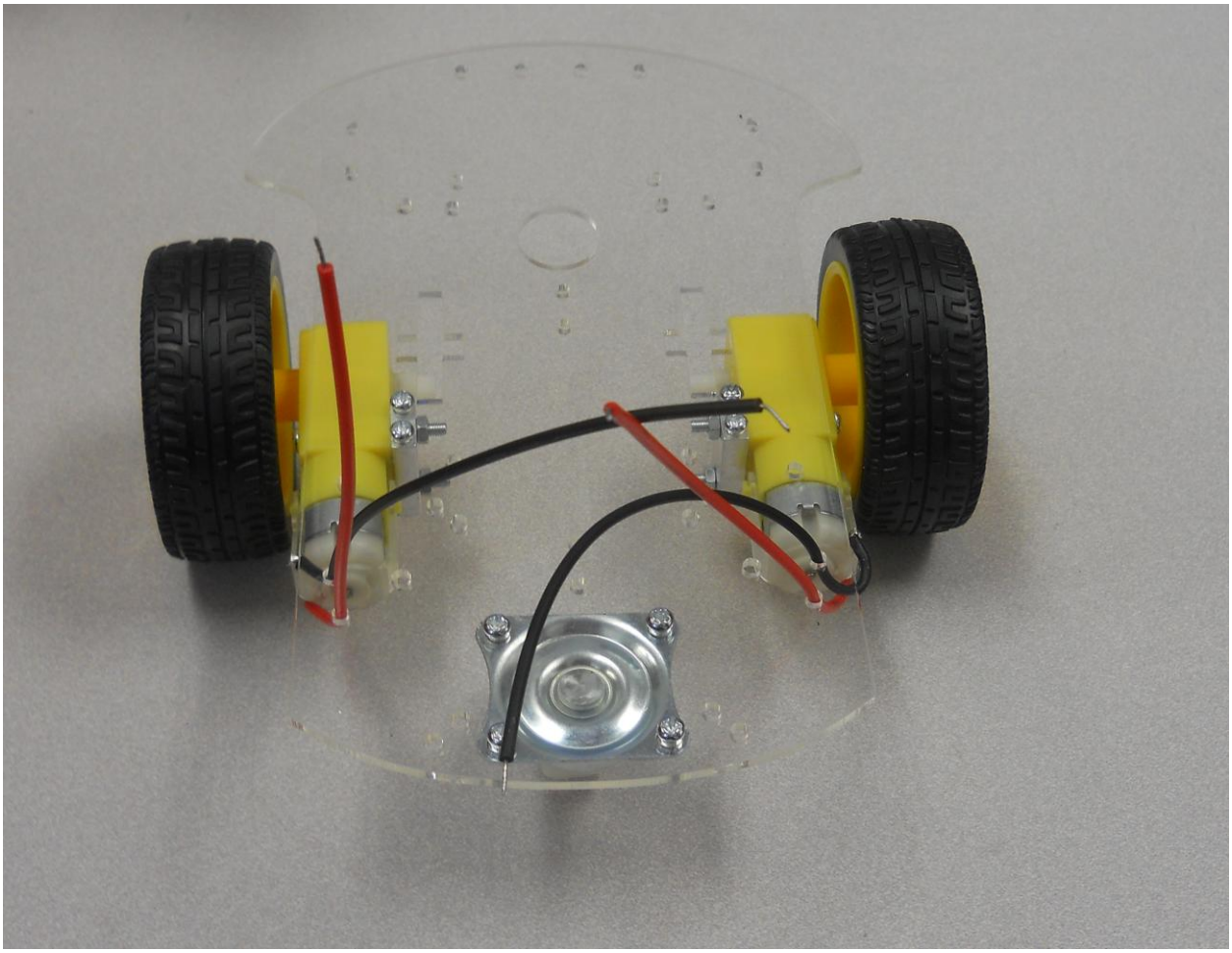

Goal
Point 6, 4
Robot
3, 1
New
Robot
6, 1
Reference
Point 0, 0

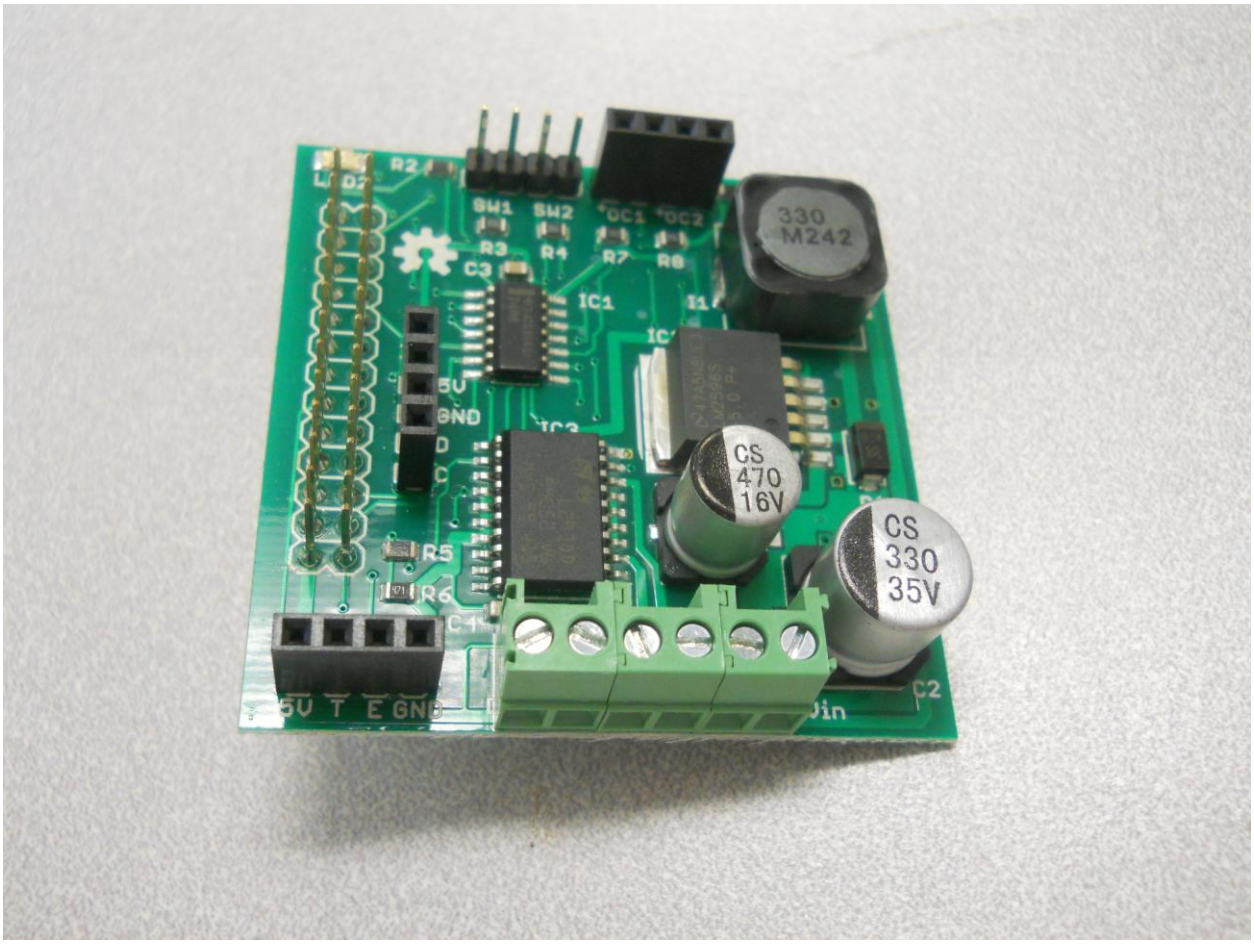

File Edit Options Buffers Tools Python Help
import RPi.GPIO as GPIO
import time
from rrb2 import *
rr = RRB2()
def init_vehicle():
rr.set_led1(1)
def turn_left():
rr.set_motors(1, 1, 1, 0)
def turn_right():
rr.set_motors(1, 0, 1, 1)
def forward():
rr.set_motors(1, 1, 1, 1)
def backward():
rr.set_motors(1, 0, 1, 0)
def stop():
rr.set_motors(0, 0, 0, 0)
def cleanup():
GPIO.cleanup()
-UU-:----F1 track.py All L5 (Python)

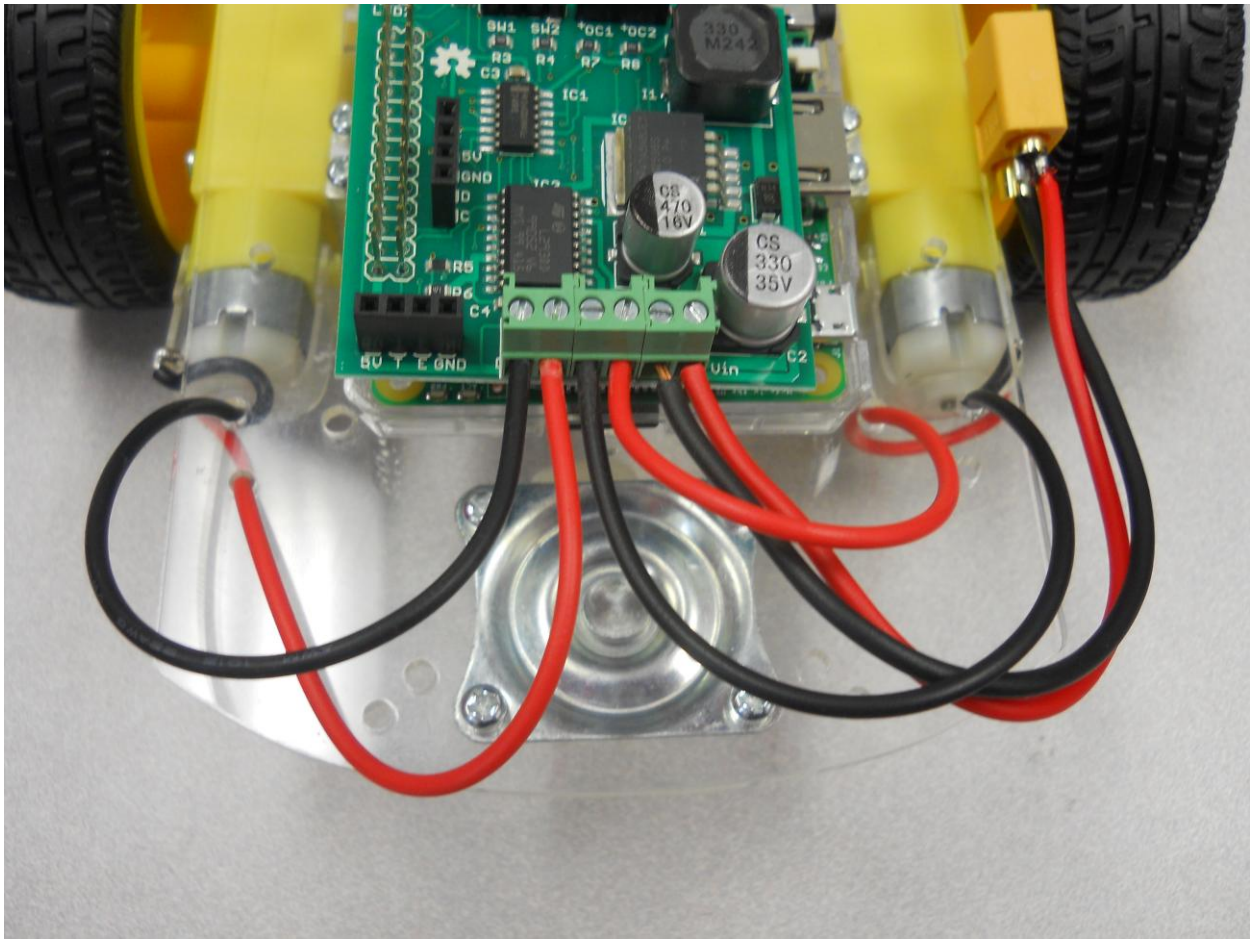

pi@raspberrypi: ~/tracked
File Edit Options Buffers Tools Python Help
#!/usr/bin/python
import serial
import time
from track import *
from libCompass import *
from rrb2 import *
import math
def move_angle(angle):
if angle < 0:
angle = angle + 360
bearing = readDirection()
move_angle = bearing - angle
if move_angle > 180:
turn_right()
elif move_angle < -180:
turn_left()
elif (move_angle) < 180 and move_angle > 0:
turn_left()
elif move_angle > -180 and move_angle < 0:
turn_right()
while(abs(angle - bearing)) > 5:
time.sleep(.2)
print abs(angle-bearing)
bearing = readDirection()
stop()
# print "angle", bearing
def positionRobot(xpos, ypos, xpos_goal, ypos_goal):
print xpos, ypos, xpos_goal, ypos_goal
distance = math.sqrt((xpos_goal - ypos_robot)**2 + (ypos_goal - ypos_robot)\
**2)
angle = round(math.degrees(math.atan2((ypos_goal - ypos_robot), (xpos_goal \
- xpos_robot))))
print "angle",angle
move_angle(angle)
print distance
return distance, angle
xpos_robot = int(raw_input("Robot X Position: "))
-UU-:----F1 robotBarrier.py Top L1 (Python)----------
For information about GNU Emacs and the GNU system, type C-h C-a.

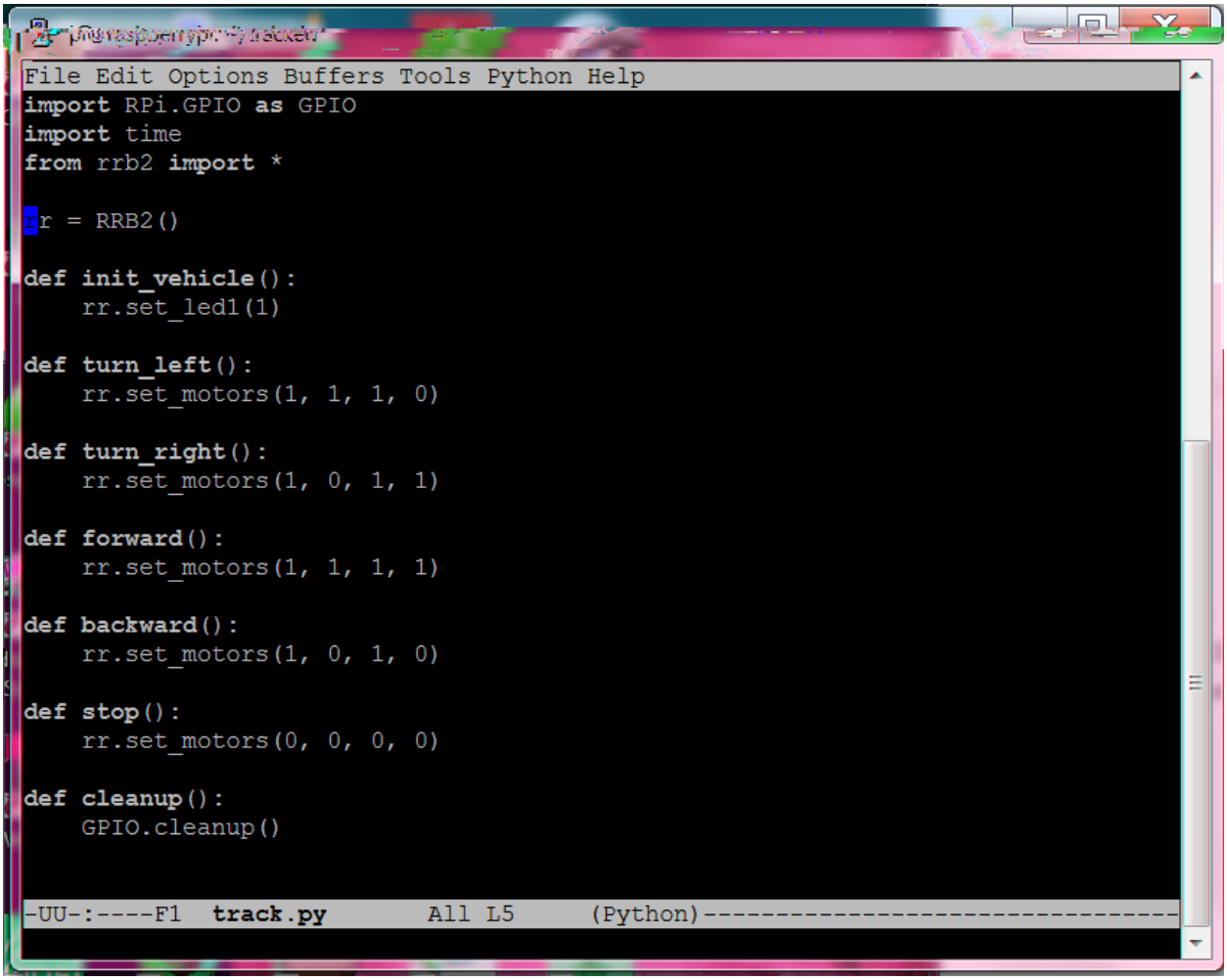

pi@raspberrypi: ~/tracked
File Edit Options Buffers Tools Python Help
xpos_robot = int(raw_input("Robot X Position: "))
ypos_robot = int(raw_input("Robot Y Position: "))
xpos_goal = int(raw_input("Goal X Position: "))
ypos_goal = int(raw_input("Goal Y Position: "))
distance, angle = positionRobot(xpos_robot, ypos_robot, xpos_goal, ypos_goal)
time.time()
get_distance()
= 0
> 10 and elapsed_time < distance:
ime = time.time() - start_time
rr.get_distance()
r > 0 and barrier < 10:
"barrier", barrier
nce_traveled = elapsed_time
istance = 1
robot = ypos_robot + distance_traveled * math.sin(math.radians(angle))
goal_barrier = ypos_robot + new_distance * math.sin(math.radians(angle + 90))
robot = xpos_robot + distance_traveled * math.cos(math.radians(angle))
goal_barrier = xpos_robot + new_distance * math.cos(math.radians(angle + 90))
nce = positionRobot(xpos_robot, ypos_robot, xpos_goal_barrier, ypos_goal_barrier)
time = time.time()
start_time = time.time()
forward()
barrier = rr.get_distance()
elapsed_time = 0
top()
rint "Goal Reached"
start_time =
forward()
barrier = rr.
elapsed_time
while barrier
elapsed_t
barrier =
if barrie
print
dista
new_d
ypos_
ypos_
xpos_
xpos_
dista
UU-:----F1 robotBarrier.py 40% L57 (Python)

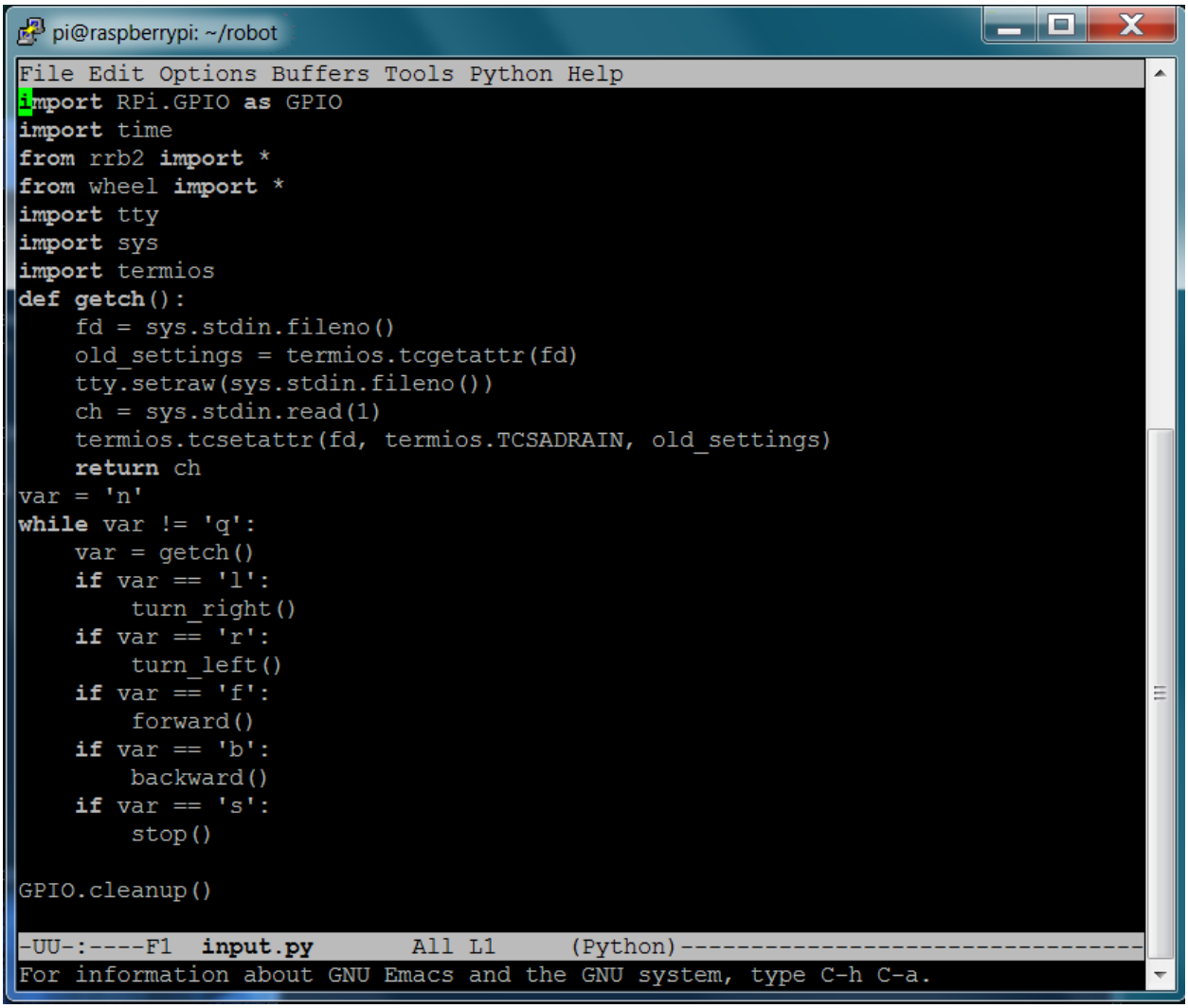
Chapter 4: Building a Robot That Can Play Laser Tag

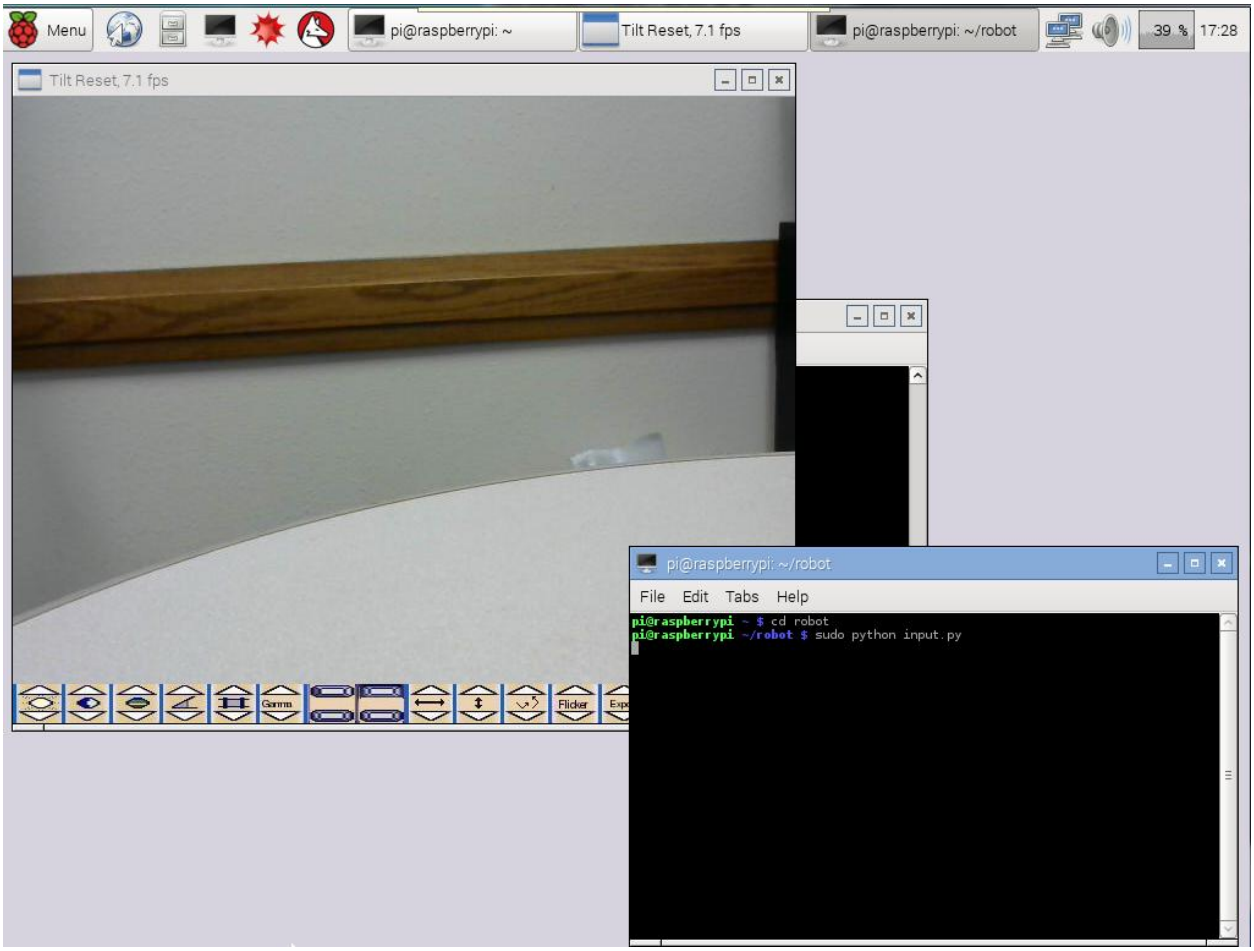


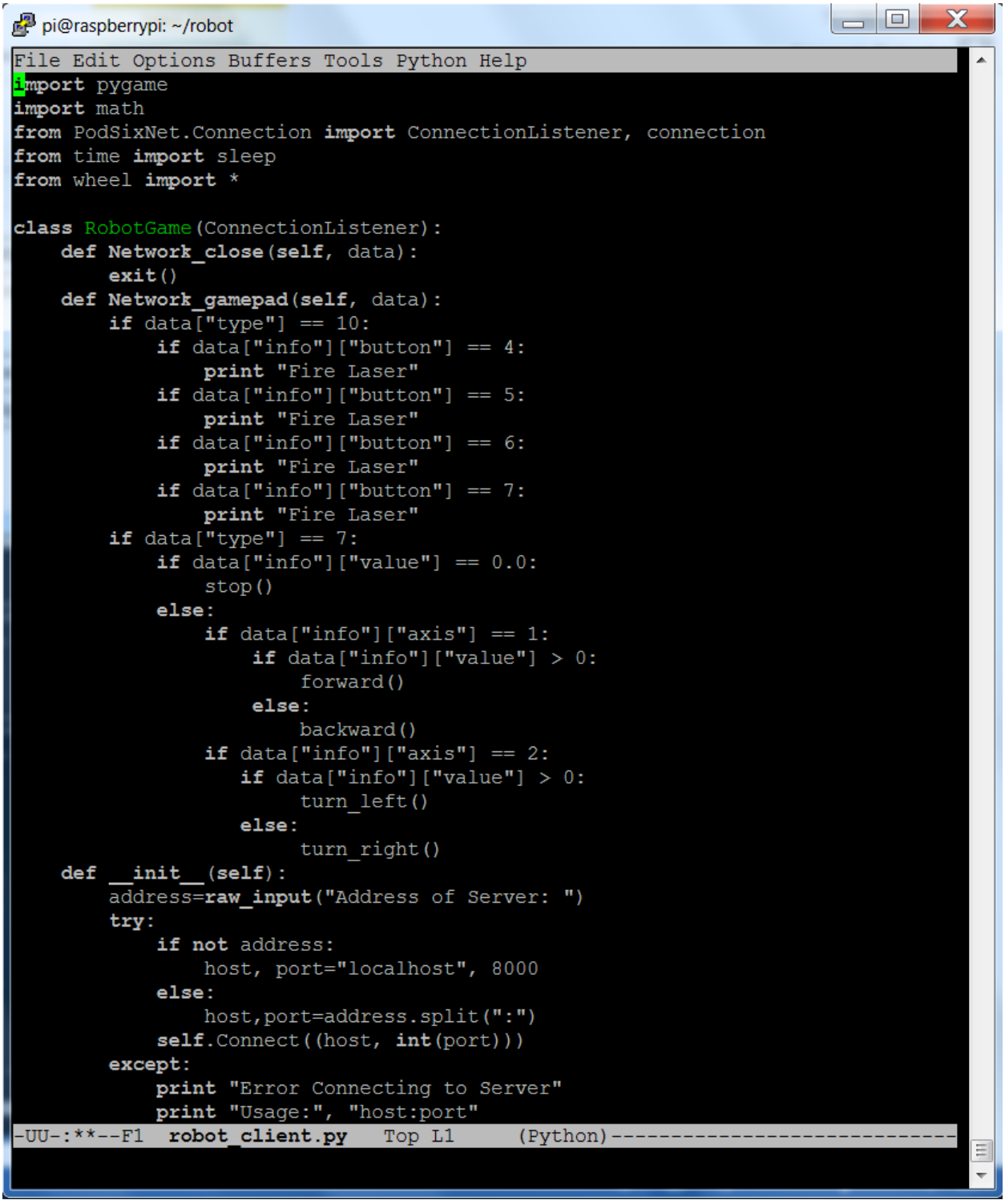

330
M242
CS
470
16V
CS
330
35V
SW1
SW2
R2
R3
R4
R5
R6
R7
R8
C3
IC1
5V
GND
5V T E GND

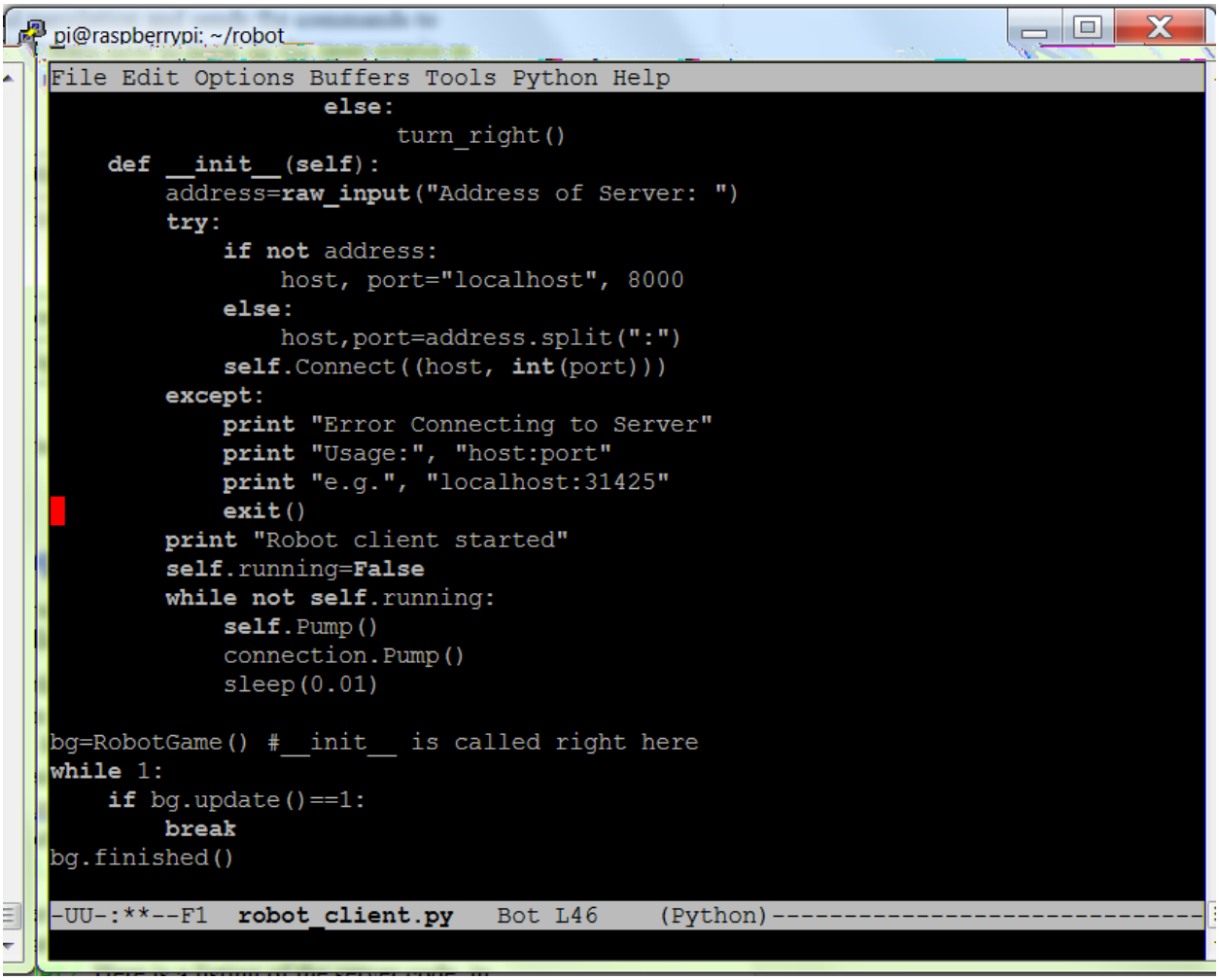

SW1
SW2
IC1
R3
R4
C3
5V
GND
C4
330
M242
CS
470
16V
CS
330
35V
Vin
C2

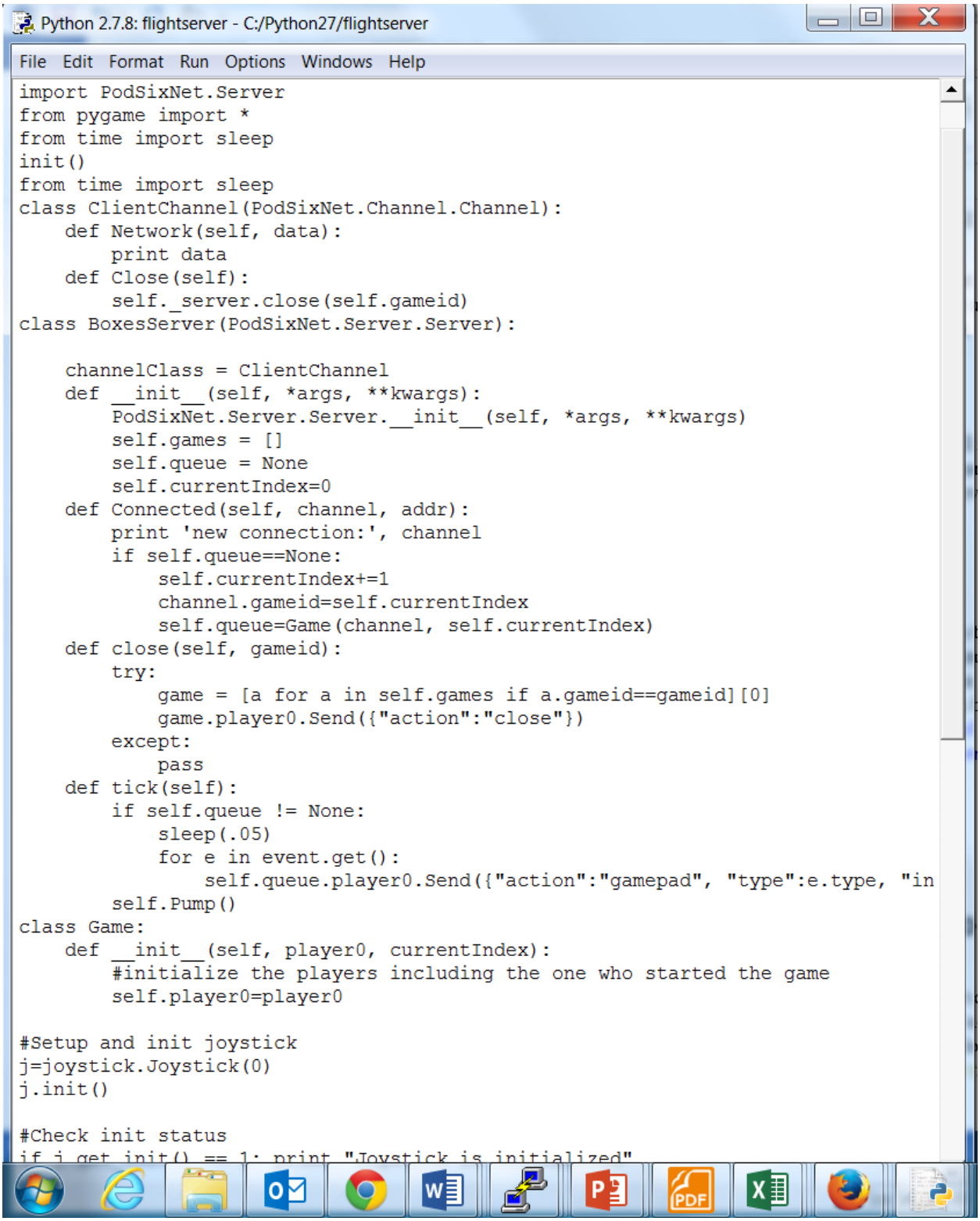

File Edit Options Buffers Tools Python Help
import RPi.GPIO as GPIO
import time
from rrb2 import *
rr = RRB2()
def init_vehicle():
rr.set_led1(1)
def turn_left():
rr.set_motors(1, 1, 1, 0)
def turn_right():
rr.set_motors(1, 0, 1, 1)
def forward():
rr.set_motors(1, 1, 1, 1)
def backward():
rr.set_motors(1, 0, 1, 0)
def stop():
rr.set_motors(0, 0, 0, 0)
def cleanup():
GPIO.cleanup()
-UU-:----F1 track.py All L5 (Python)

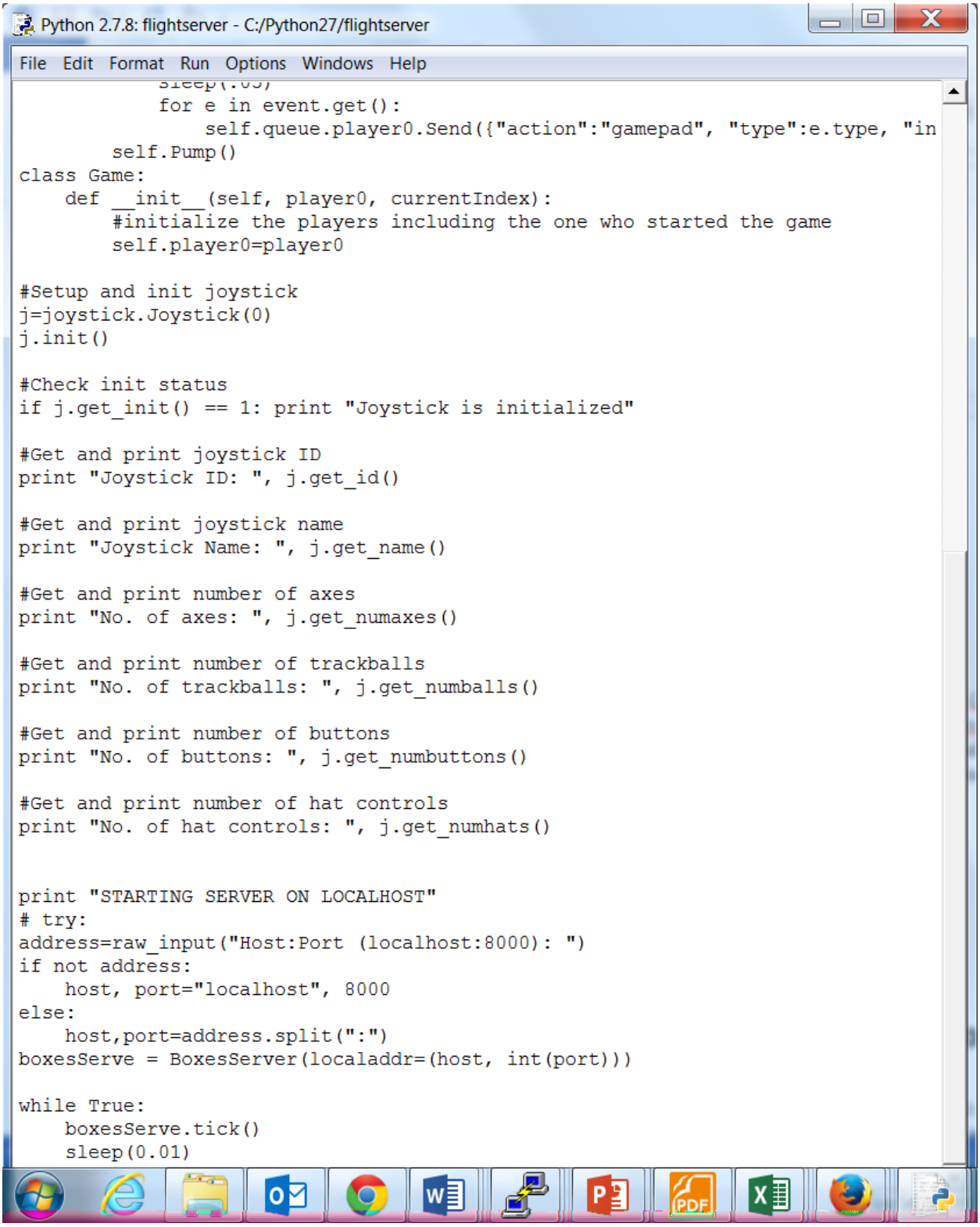

pi@raspberrypi: ~/robot
File Edit Options Buffers Tools Python Help
import RPi.GPIO as GPIO
import time
from rrb2 import *
from wheel import *
import tty
import sys
import termios
def getch():
fd = sys.stdin.fileno()
old_settings = termios.tcgetattr(fd)
tty.setraw(sys.stdin.fileno())
ch = sys.stdin.read(1)
termios.tcsetattr(fd, termios.TCSADRAIN, old_settings)
return ch
var = 'n'
while var != 'q':
var = getch()
if var == 'l':
turn_right()
if var == 'r':
turn_left()
if var == 'f':
forward()
if var == 'b':
backward()
if var == 's':
stop()
GPIO.cleanup()
-UU-:----F1 input.py All L1 (Python)
For information about GNU Emacs and the GNU system, type C-h C-a.

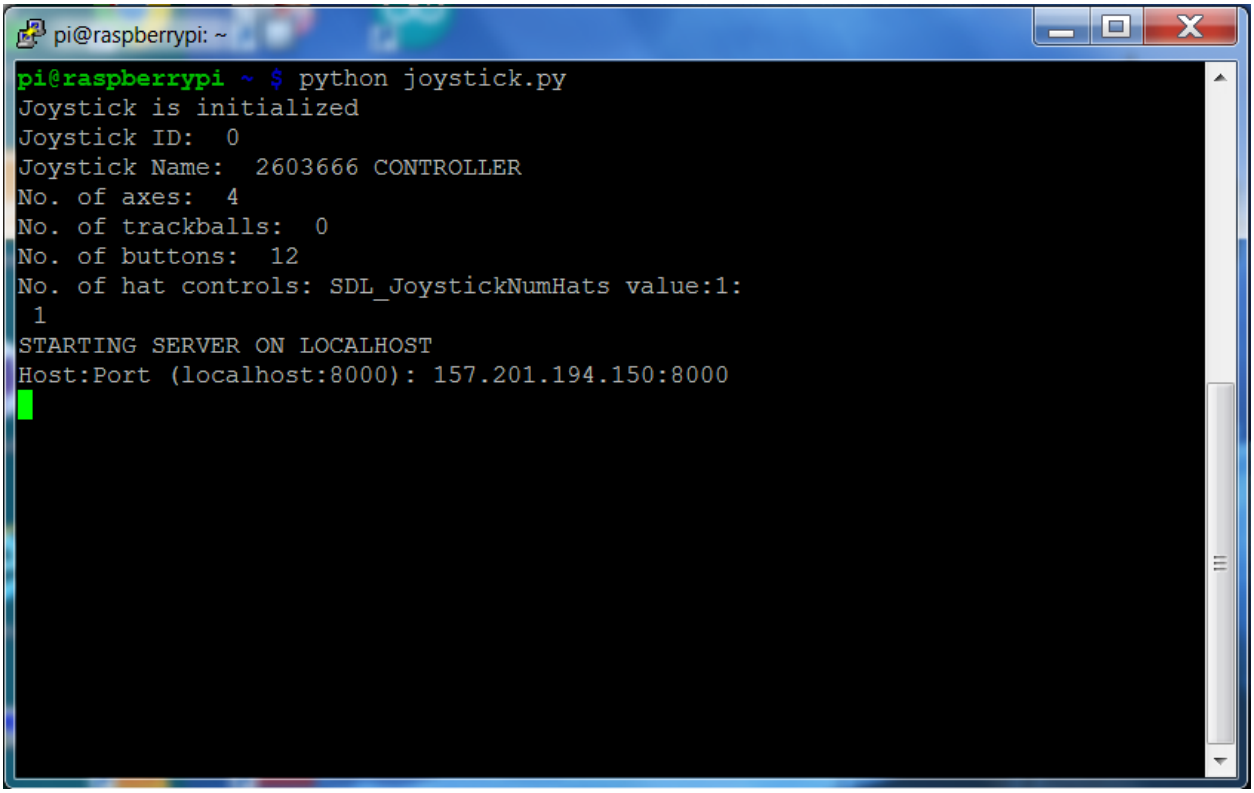

Menu
pi@raspberrypi: ~
Tilt Reset, 7.1 fps
pi@raspberrypi: ~/robot
39 %
17:28
Tilt Reset, 7.1 fps
Gamma
Flicker
pi@raspberrypi: ~/robot
File Edit Tabs Help
pi@raspberrypi ~ $ cd robot
pi@raspberrypi ~/robot $ sudo python input.py

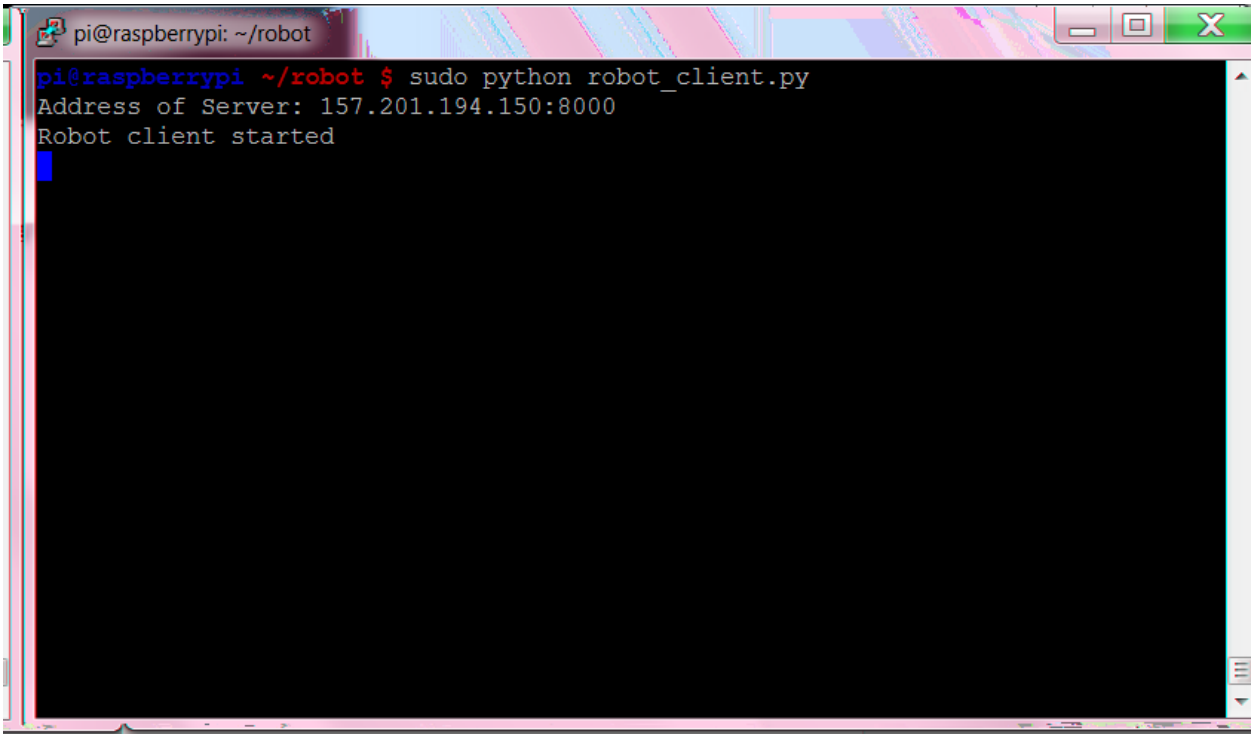

pi@raspberrypi: ~/robot
File Edit Options Buffers Tools Python Help
import pygame
import math
from PodSixNet.Connection import ConnectionListener, connection
from time import sleep
from wheel import *
class RobotGame(ConnectionListener):
def Network_close(self, data):
exit()
def Network_gamepad(self, data):
if data["type"] == 10:
if data["info"]["button"] == 4:
print "Fire Laser"
if data["info"]["button"] == 5:
print "Fire Laser"
if data["info"]["button"] == 6:
print "Fire Laser"
if data["info"]["button"] == 7:
print "Fire Laser"
if data["type"] == 7:
if data["info"]["value"] == 0.0:
stop()
else:
if data["info"]["axis"] == 1:
if data["info"]["value"] > 0:
forward()
else:
backward()
if data["info"]["axis"] == 2:
if data["info"]["value"] > 0:
turn_left()
else:
turn_right()
def __init__(self):
address=raw_input("Address of Server: ")
try:
if not address:
host, port="localhost", 8000
else:
host,port=address.split(":")
self.Connect((host, int(port)))
except:
print "Error Connecting to Server"
print "Usage:", "host:port"
-UU-:**--F1 robot_client.py Top L1 (Python)

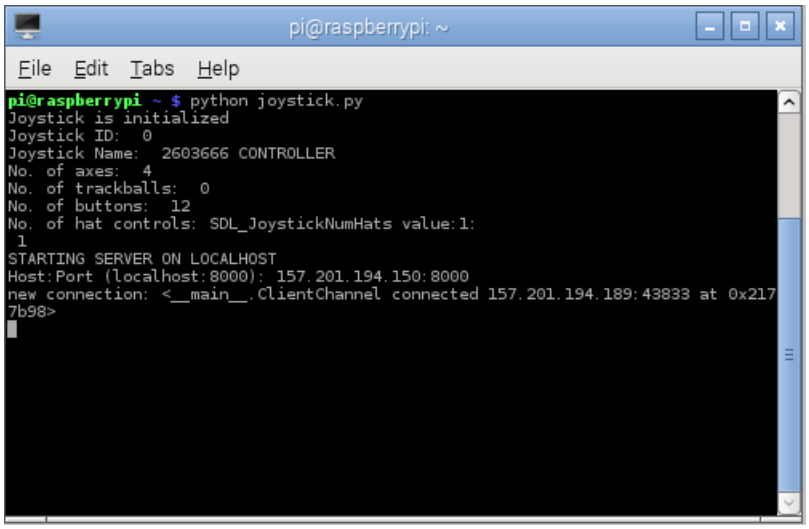

pi@raspberrypi: ~/robot
File Edit Options Buffers Tools Python Help
else:
turn_right()
def __init__(self):
address=raw_input("Address of Server: ")
try:
if not address:
host, port="localhost", 8000
else:
host,port=address.split(":")
self.Connect((host, int(port)))
except:
print "Error Connecting to Server"
print "Usage:", "host:port"
print "e.g.", "localhost:31425"
exit()
print "Robot client started"
self.running=False
while not self.running:
self.Pump()
connection.Pump()
sleep(0.01)
bg=RobotGame() #__init__ is called right here
while 1:
if bg.update()==1:
break
bg.finished()
-UU-:**--F1 robot_client.py Bot L46 (Python)

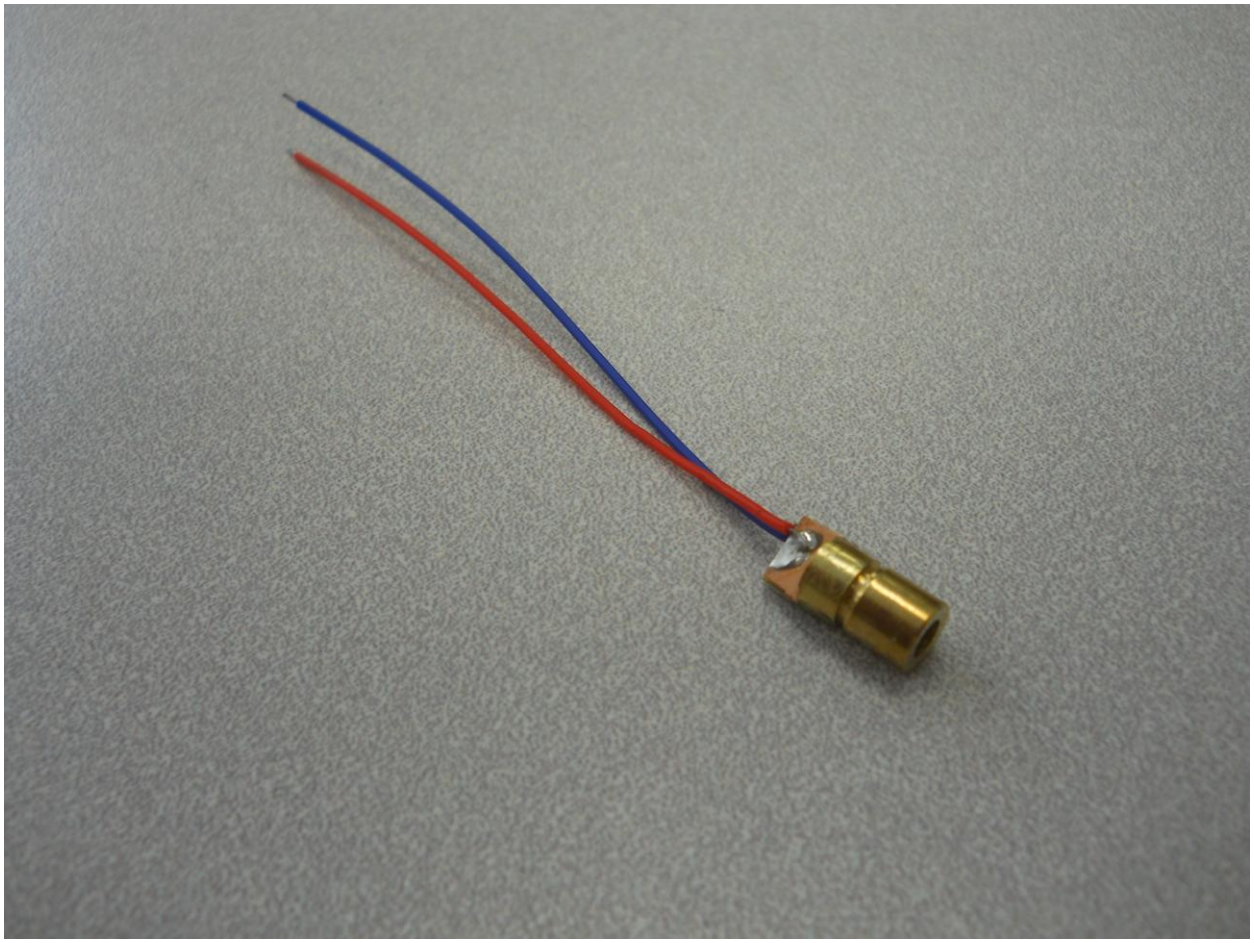

Python 2.7.8: flightserver - C:/Python27/flightserver
File Edit Format Run Options Windows Help
import PodSixNet.Server
from pygame import *
from time import sleep
init()
from time import sleep
class ClientChannel(PodSixNet.Channel.Channel):
def Network(self, data):
print data
def Close(self):
self._server.close(self.gameid)
class BoxesServer(PodSixNet.Server.Server):
channelClass = ClientChannel
def __init__(self, *args, **kwargs):
PodSixNet.Server.Server.__init__(self, *args, **kwargs)
self.games = []
self.queue = None
self.currentIndex=0
def Connected(self, channel, addr):
print 'new connection:', channel
if self.queue==None:
self.currentIndex+=1
channel.gameid=self.currentIndex
self.queue=Game(channel, self.currentIndex)
def close(self, gameid):
try:
game = [a for a in self.games if a.gameid==gameid][0]
game.player0.Send({"action":"close"})
except:
pass
def tick(self):
if self.queue != None:
sleep(.05)
for e in event.get():
self.queue.player0.Send({"action":"gamepad", "type":e.type, "in
self.Pump()
class Game:
def __init__(self, player0, currentIndex):
#initialize the players including the one who started the game
self.player0=player0
#Setup and init joystick
j=joystick.Joystick(0)
j.init()
#Check init status

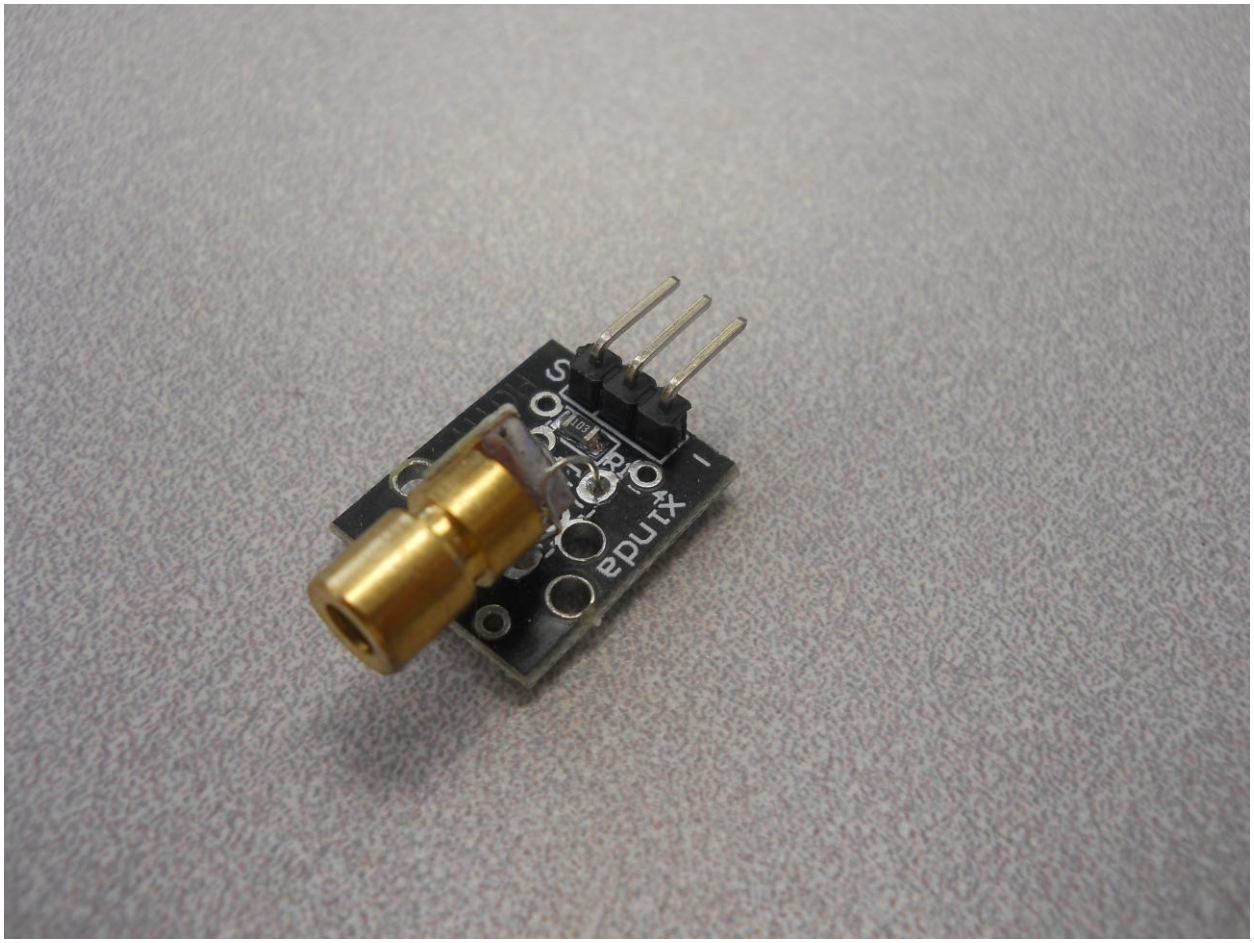

Python 2.7.8: flightserver - C:/Python27/flightserver
File Edit Format Run Options Windows Help
for e in event.get():
self.queue.player0.Send({"action":"gamepad", "type":e.type, "in
self.Pump()
class Game:
def __init__(self, player0, currentIndex):
#initialize the players including the one who started the game
self.player0=player0
#Setup and init joystick
j=joystick.Joystick(0)
j.init()
#Check init status
if j.get_init() == 1: print "Joystick is initialized"
#Get and print joystick ID
print "Joystick ID: ", j.get_id()
#Get and print joystick name
print "Joystick Name: ", j.get_name()
#Get and print number of axes
print "No. of axes: ", j.get_numaxes()
#Get and print number of trackballs
print "No. of trackballs: ", j.get_numballs()
#Get and print number of buttons
print "No. of buttons: ", j.get_numbuttons()
#Get and print number of hat controls
print "No. of hat controls: ", j.get_numhats()
print "STARTING SERVER ON LOCALHOST"
# try:
address=raw_input("Host:Port (localhost:8000): ")
if not address:
host, port="localhost", 8000
else:
host,port=address.split(":")
boxesServe = BoxesServer(localaddr=(host, int(port)))
while True:
boxesServe.tick()
sleep(0.01)

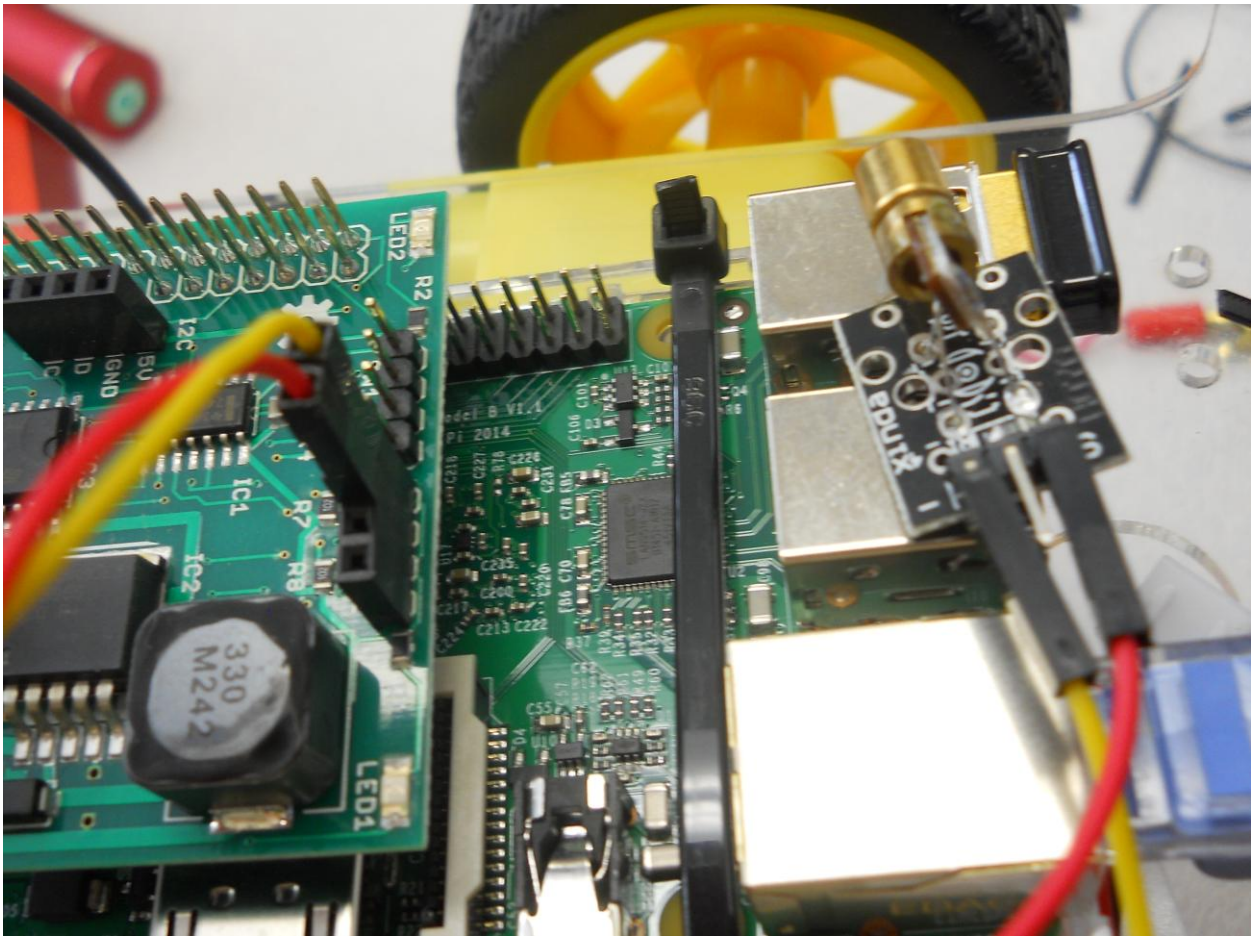

pi@raspberrypi: ~
pi@raspberrypi ~ $ python joystick.py
Joystick is initialized
Joystick ID: 0
Joystick Name: 2603666 CONTROLLER
No. of axes: 4
No. of trackballs: 0
No. of buttons: 12
No. of hat controls: SDL_JoystickNumHats value:1:
1
STARTING SERVER ON LOCALHOST
Host:Port (localhost:8000): 157.201.194.150:8000

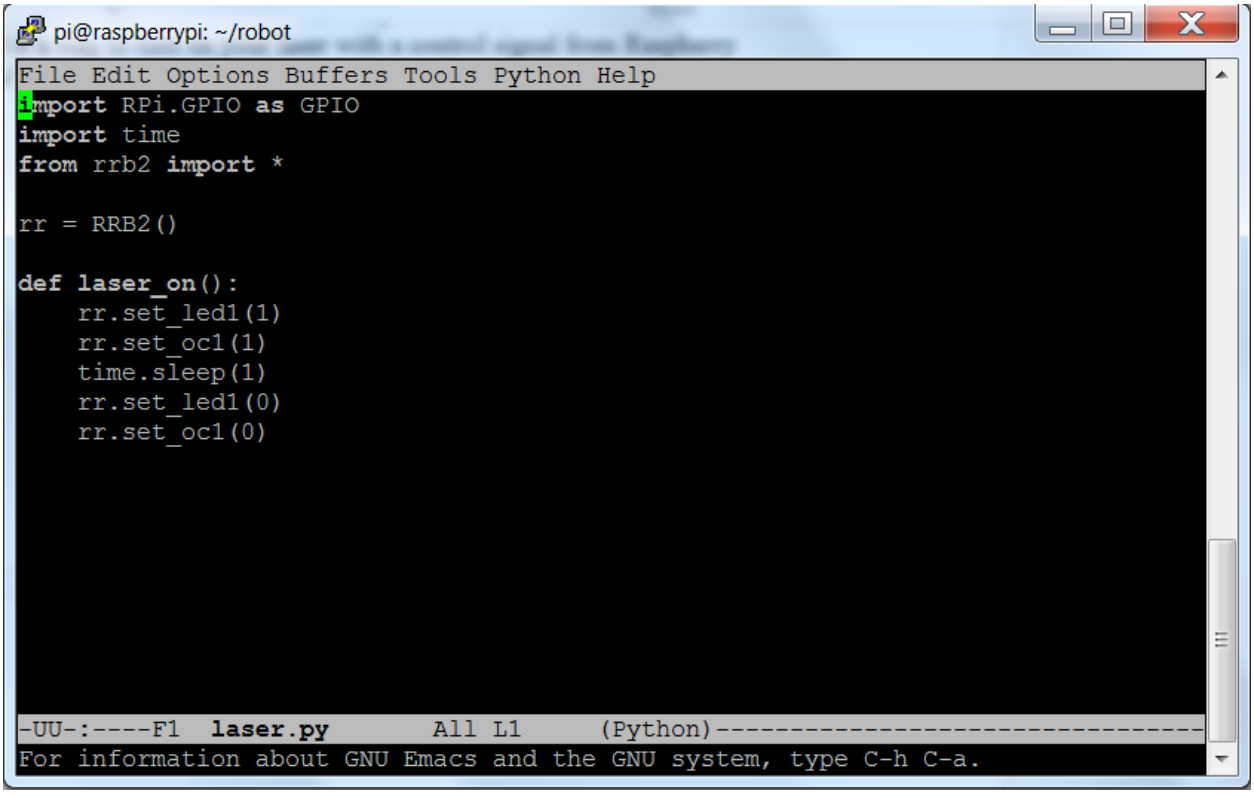

pi@raspberrypi: ~/robot
pi@raspberrypi ~/robot $ sudo python robot_client.py
Address of Server: 157.201.194.150:8000
Robot client started

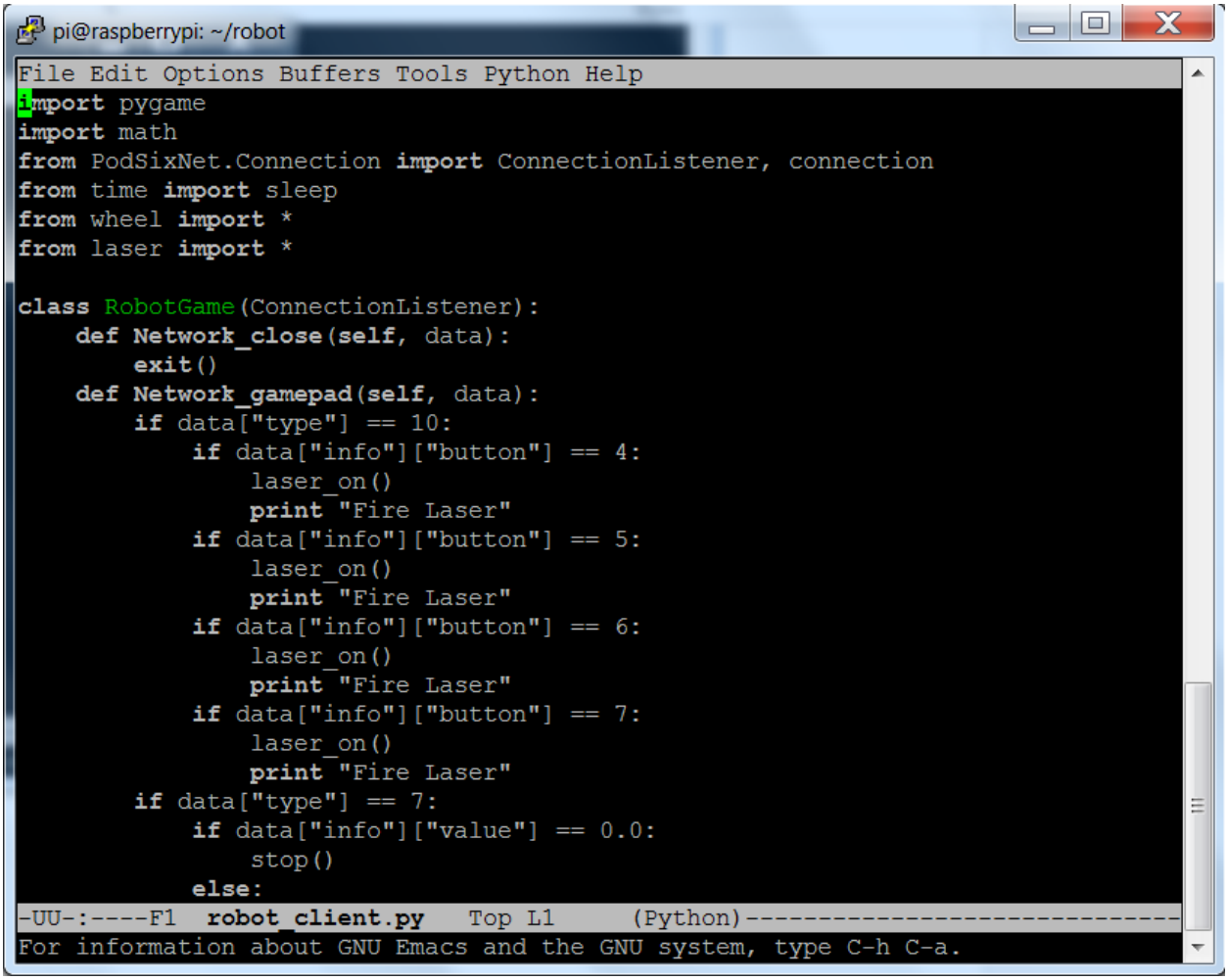

pi@raspberrypi: ~
File Edit Tabs Help
pi@raspberrypi ~ $ python joystick.py
Joystick is initialized
Joystick ID: 0
Joystick Name: 2603666 CONTROLLER
No. of axes: 4
No. of trackballs: 0
No. of buttons: 12
No. of hat controls: SDL_JoystickNumHats value:1:
1
STARTING SERVER ON LOCALHOST
Host:Port (localhost:8000): 157.201.194.150:8000
new connection: <__main__.ClientChannel connected 157.201.194.189:43833 at 0x217
7b98>

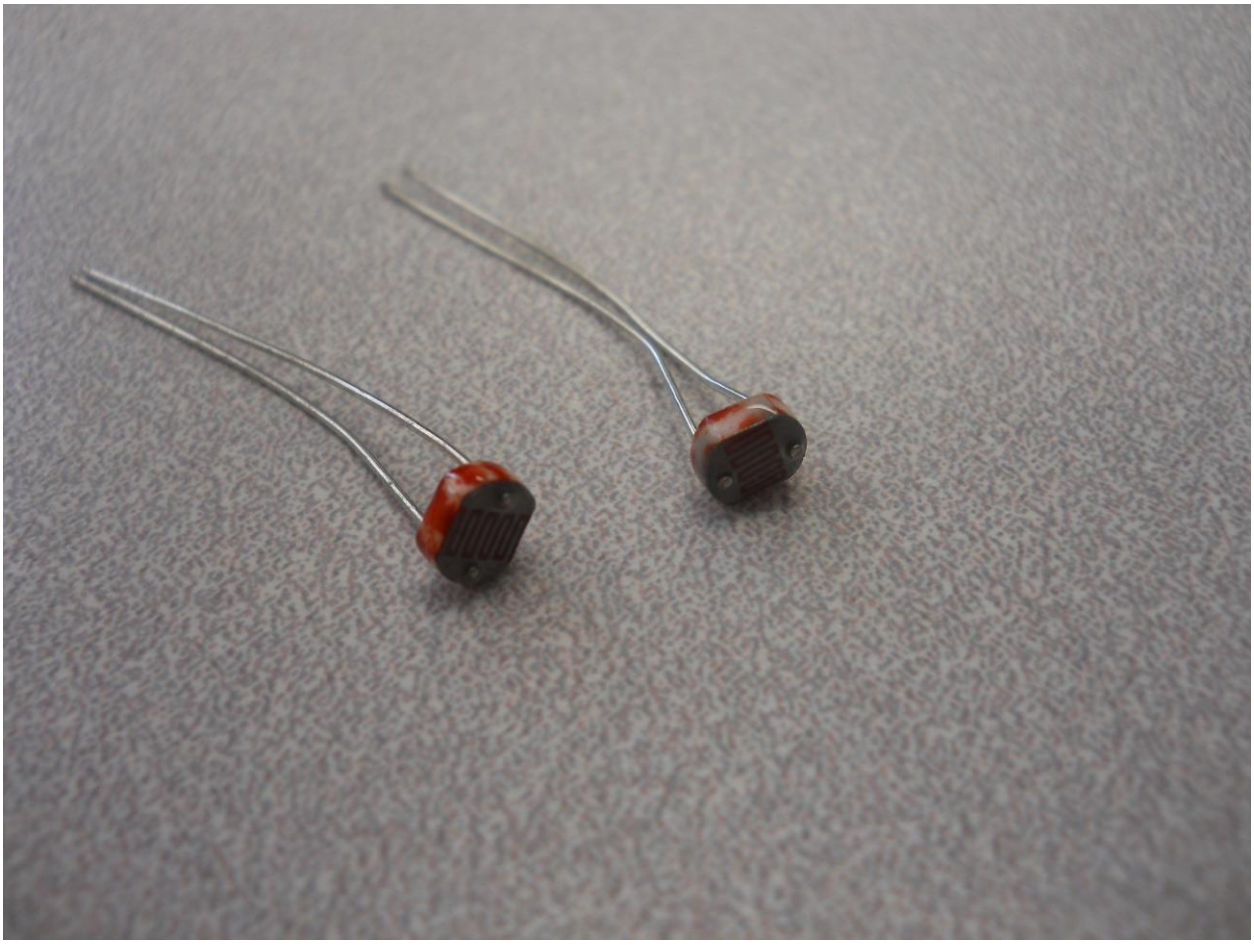


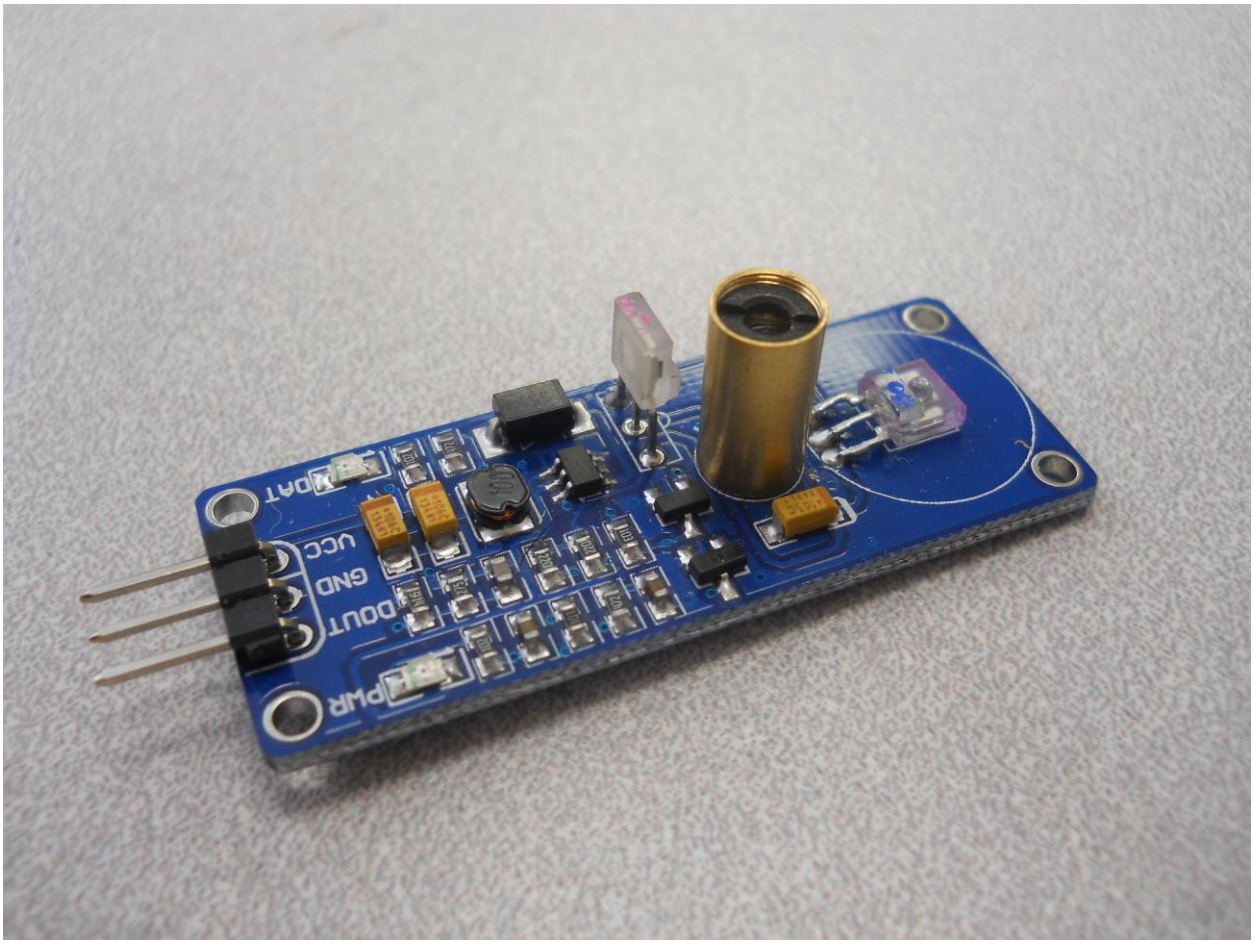

S
epuix

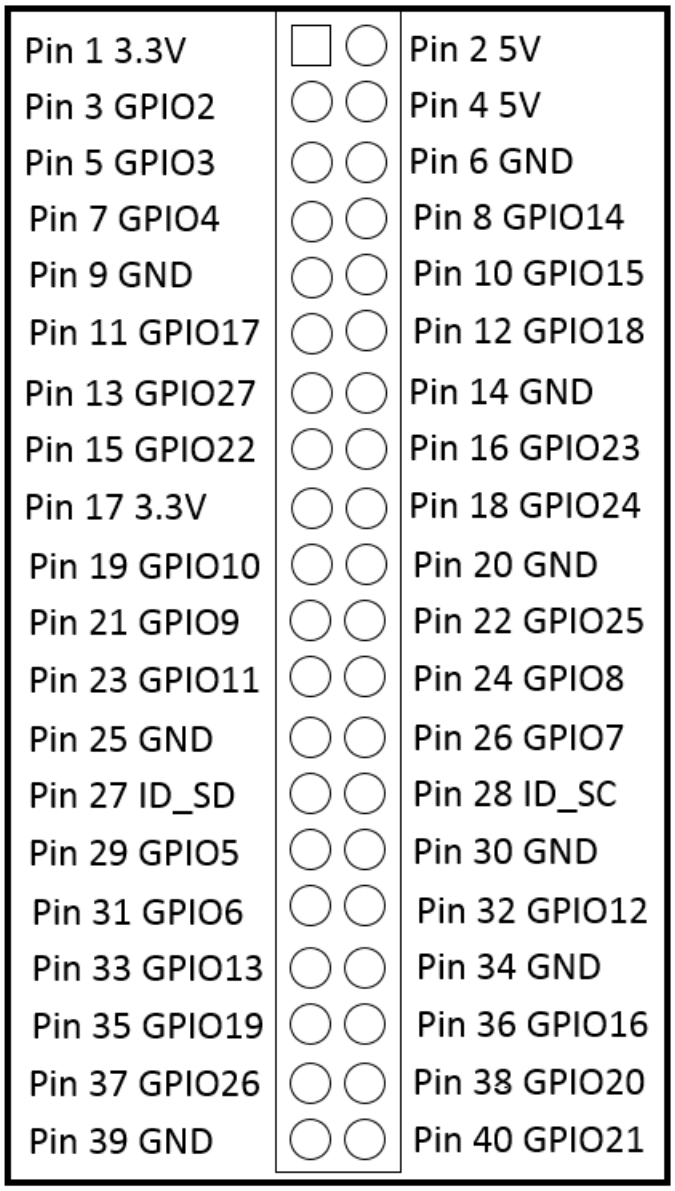

LED2
R2
I2C
IC1
IC2
R7
R8
330
M242
LED1
Model B V1.1
Pi 2014
BOUTIX

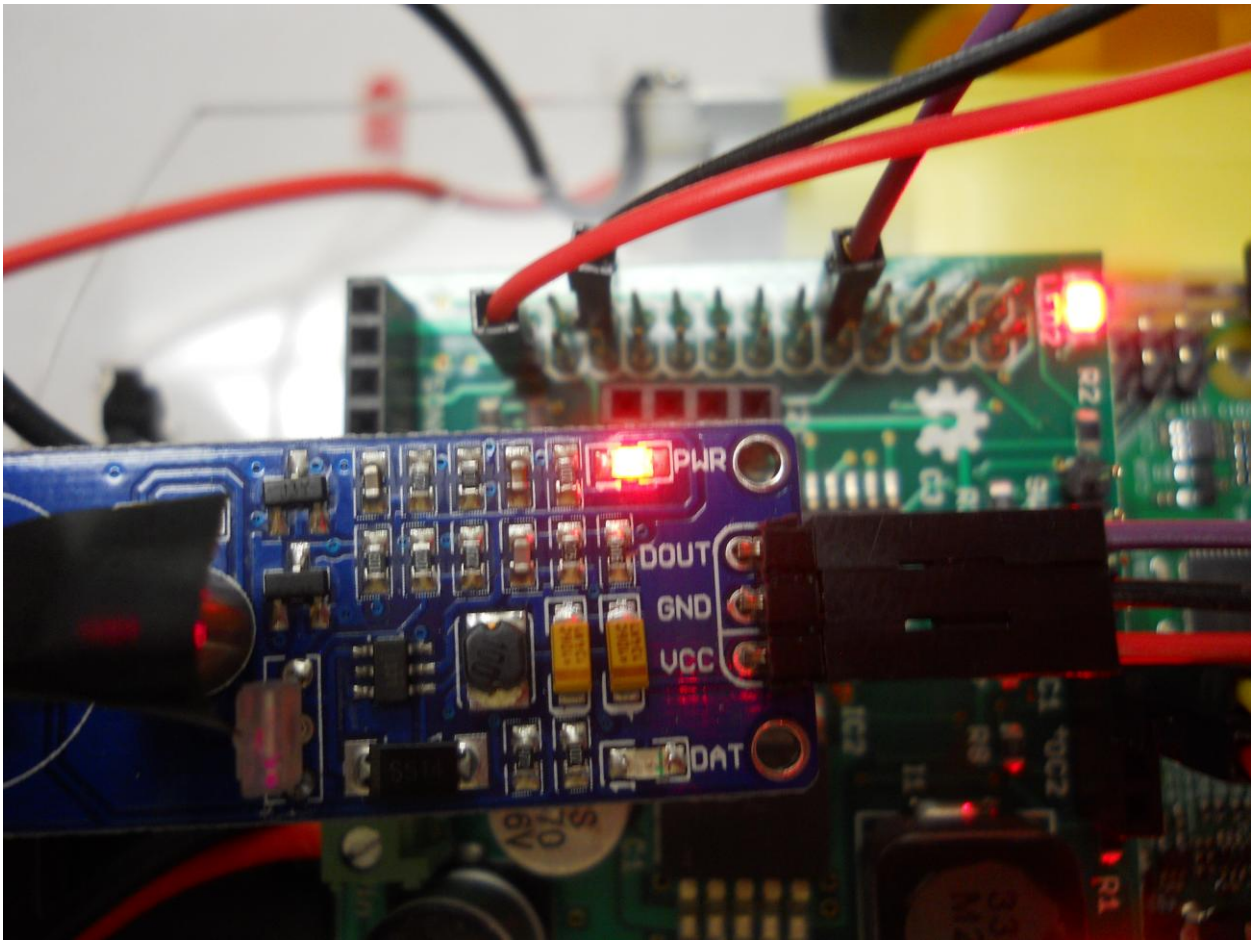

pi@raspberrypi: ~/robot
File Edit Options Buffers Tools Python Help
import RPi.GPIO as GPIO
import time
from rrb2 import *
rr = RRB2()
def laser_on():
rr.set_led1(1)
rr.set_oc1(1)
time.sleep(1)
rr.set_led1(0)
rr.set_oc1(0)
-UU-:----F1 laser.py All L1 (Python)
For information about GNU Emacs and the GNU system, type C-h C-a.

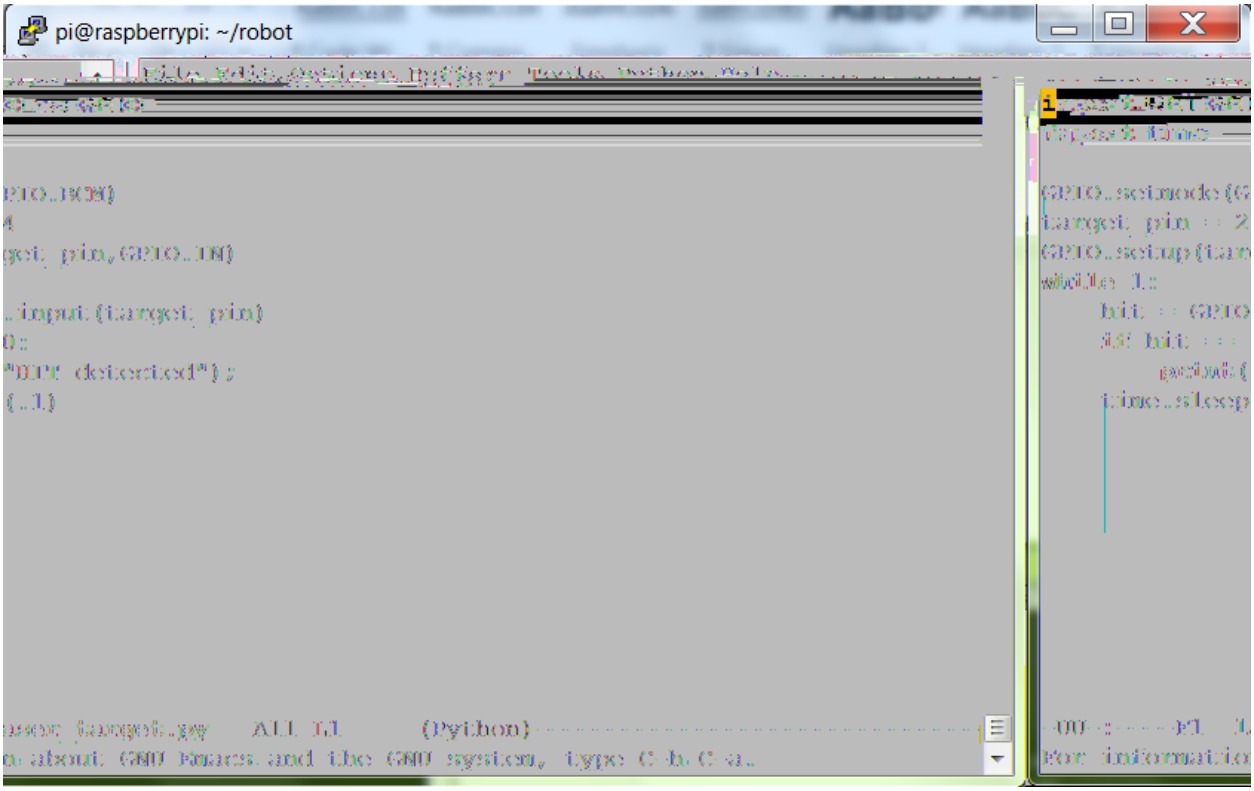

pi@raspberrypi: ~/robot
File Edit Options Buffers Tools Python Help
import pygame
import math
from PodSixNet.Connection import ConnectionListener, connection
from time import sleep
from wheel import *
from laser import *
class RobotGame(ConnectionListener):
def Network_close(self, data):
exit()
def Network_gamepad(self, data):
if data["type"] == 10:
if data["info"]["button"] == 4:
laser_on()
print "Fire Laser"
if data["info"]["button"] == 5:
laser_on()
print "Fire Laser"
if data["info"]["button"] == 6:
laser_on()
print "Fire Laser"
if data["info"]["button"] == 7:
laser_on()
print "Fire Laser"
if data["type"] == 7:
if data["info"]["value"] == 0.0:
stop()
else:
-UU-:----F1 robot_client.py Top L1 (Python)
For information about GNU Emacs and the GNU system, type C-h C-a.



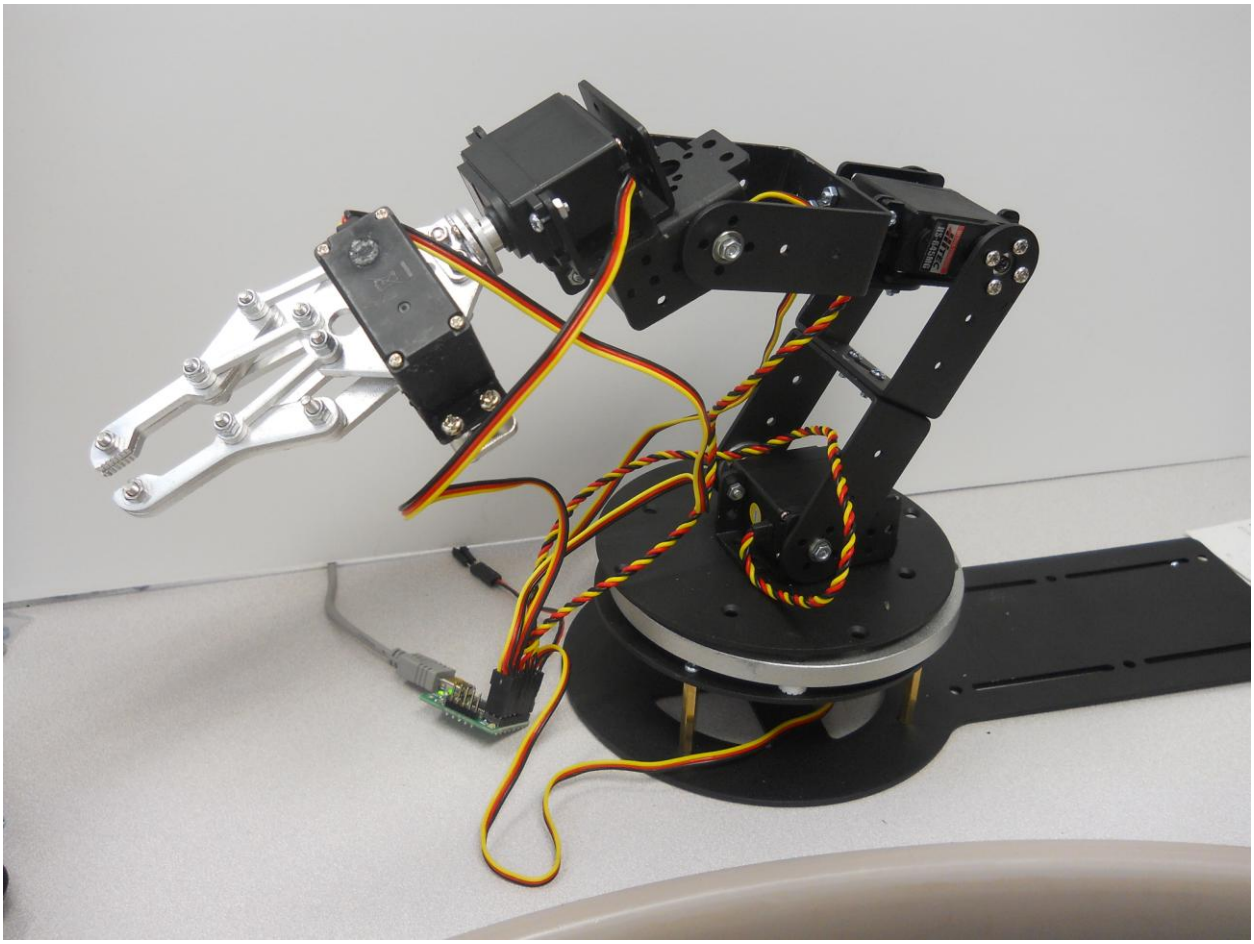

VCC
GND
DOUT
PWR


Pin 1 3.3V
Pin 2 5V
Pin 3 GPIO2
Pin 4 5V
Pin 5 GPIO3
Pin 6 GND
Pin 7 GPIO4
Pin 8 GPIO14
Pin 9 GND
Pin 10 GPIO15
Pin 11 GPIO17
Pin 12 GPIO18
Pin 13 GPIO27
Pin 14 GND
Pin 15 GPIO22
Pin 16 GPIO23
Pin 17 3.3V
Pin 18 GPIO24
Pin 19 GPIO10
Pin 20 GND
Pin 21 GPIO9
Pin 22 GPIO25
Pin 23 GPIO11
Pin 24 GPIO8
Pin 25 GND
Pin 26 GPIO7
Pin 27 ID_SD
Pin 28 ID_SC
Pin 29 GPIO5
Pin 30 GND
Pin 31 GPIO6
Pin 32 GPIO12
Pin 33 GPIO13
Pin 34 GND
Pin 35 GPIO19
Pin 36 GPIO16
Pin 37 GPIO26
Pin 38 GPIO20
Pin 39 GND
Pin 40 GPIO21

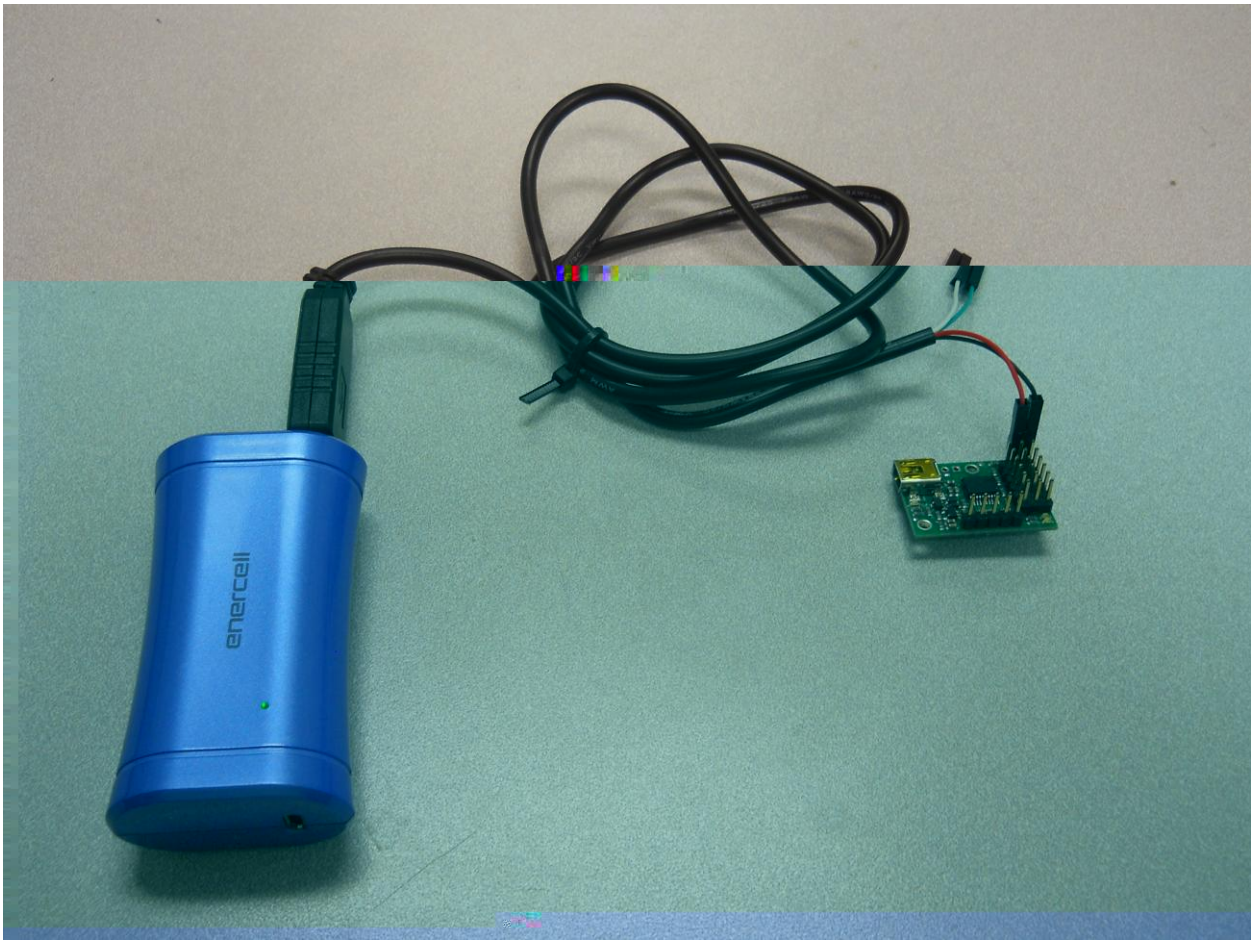

PWR
DOUT
GND
VCC
DAT

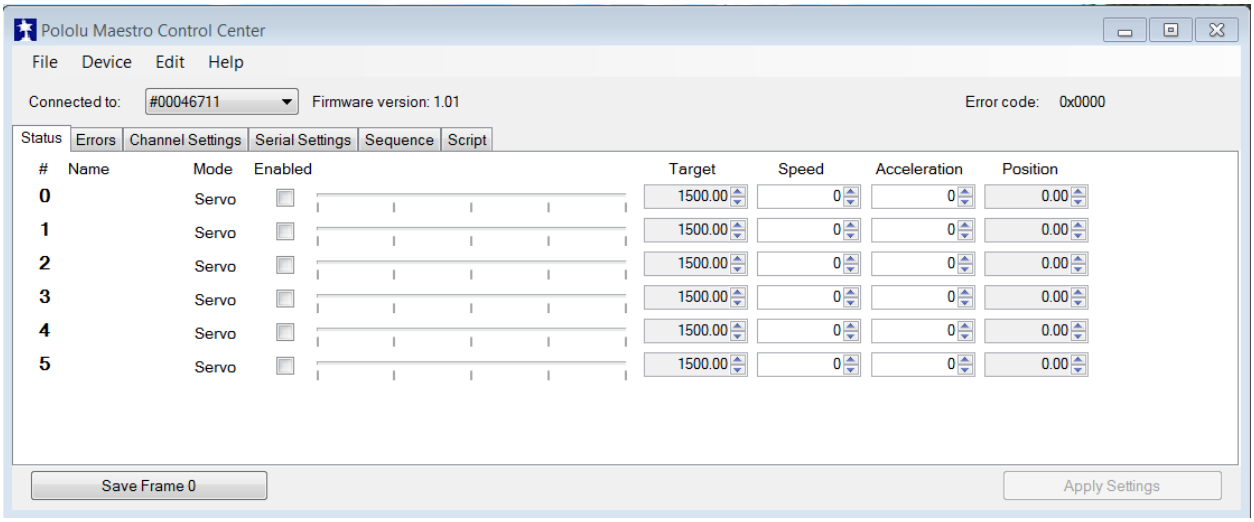

pi@raspberrypi: ~/robot

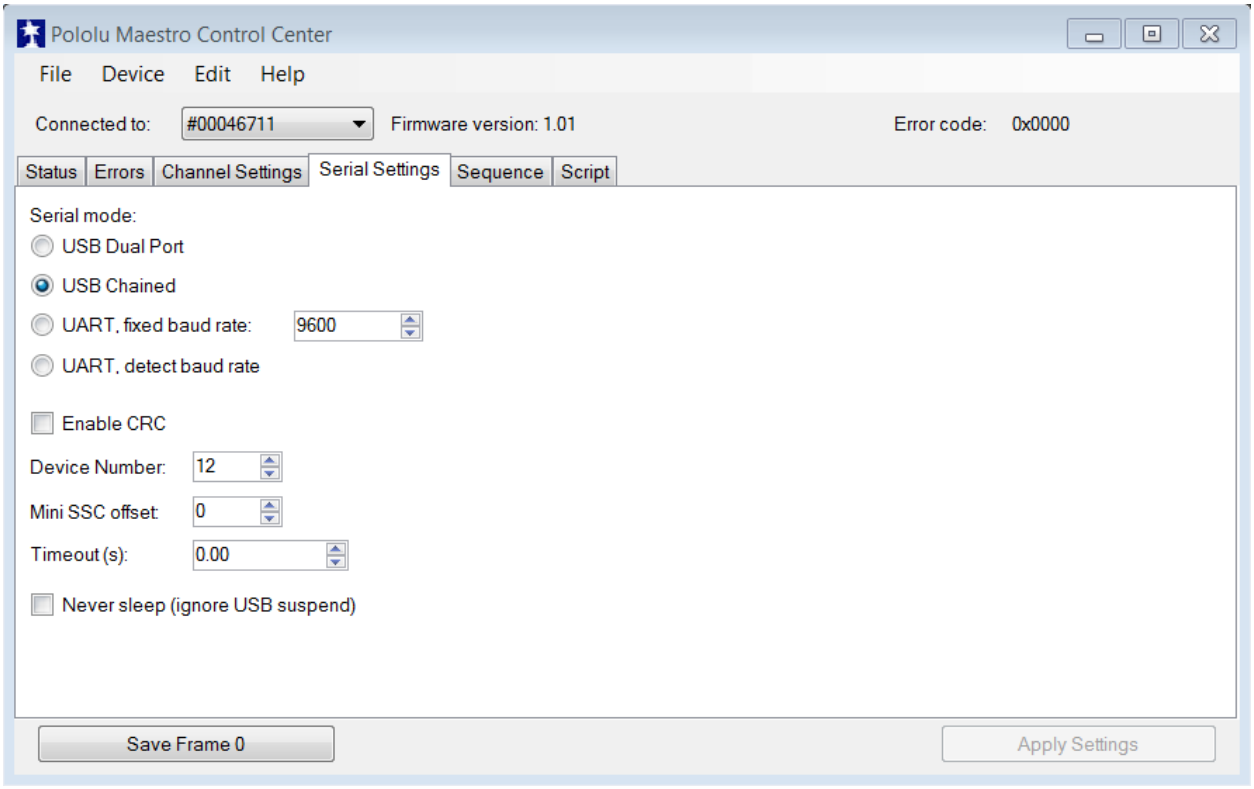
Chapter 5: A Robot That Can Draw

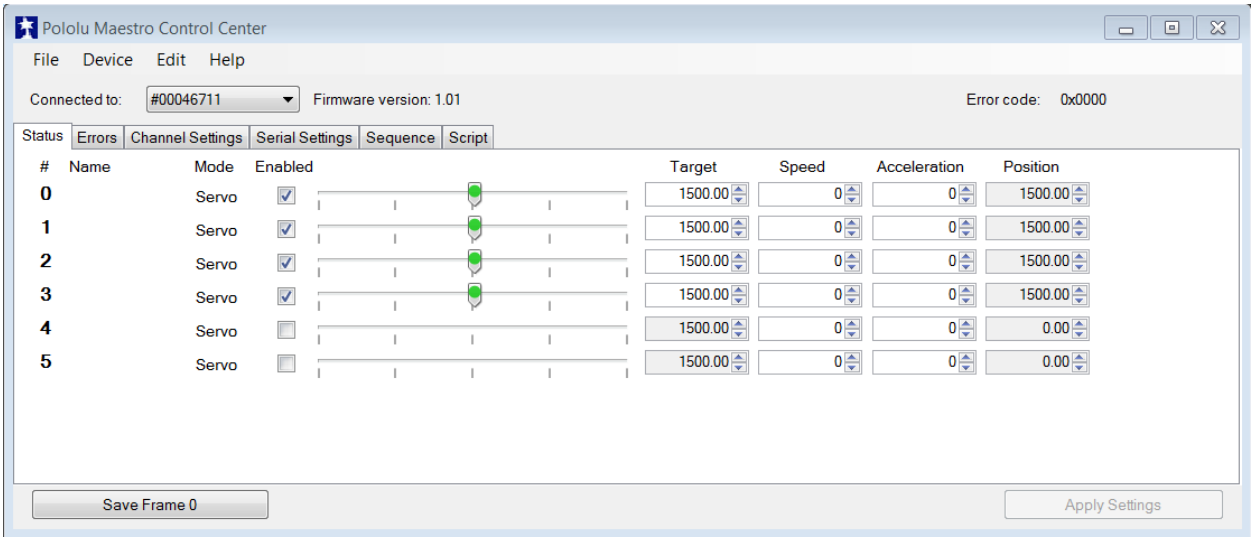


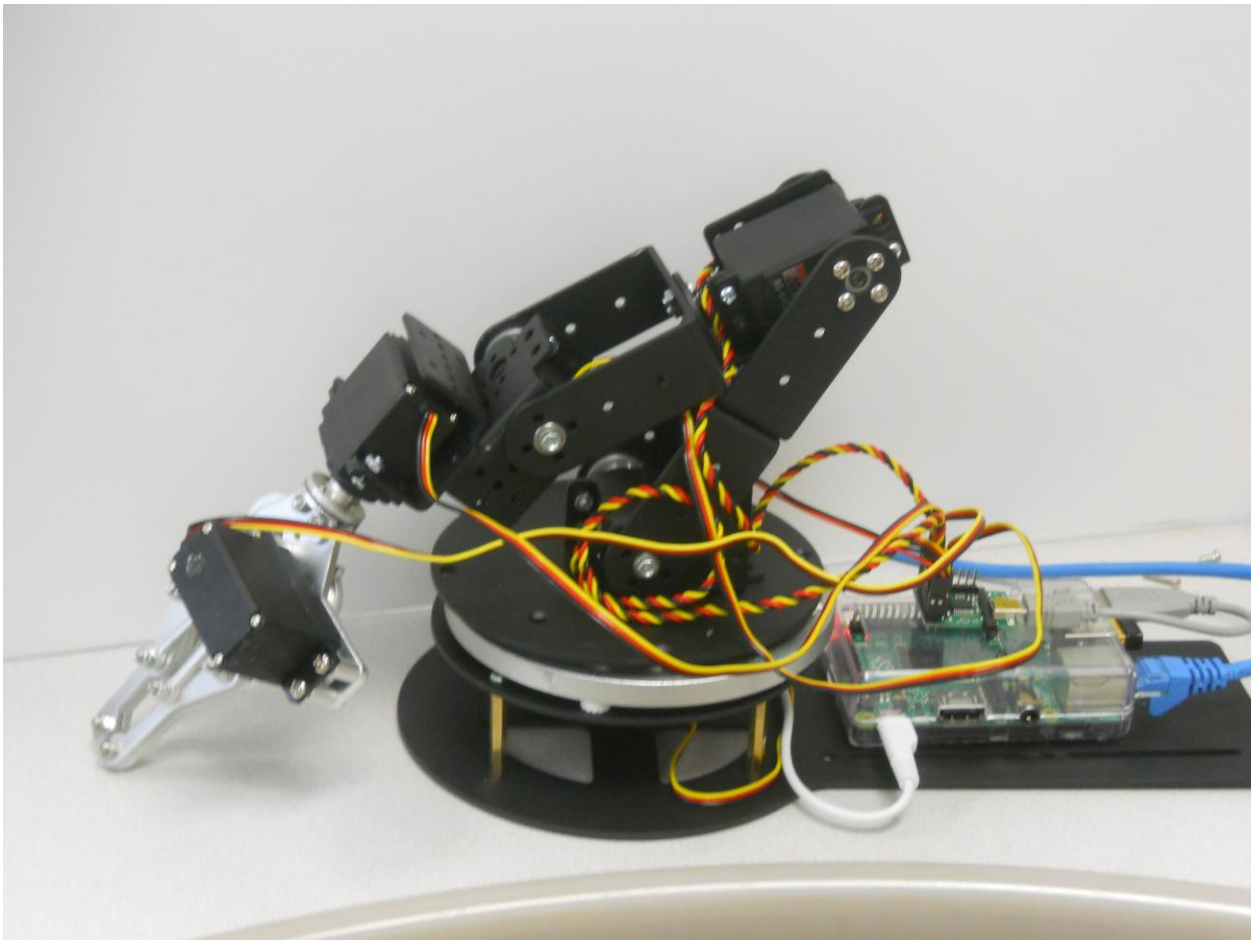

BAT
+5V
(out)
GND
0
1
2
3
4
5
GND
PWR
SIG
6J1433
U8C02A
Pololu
©2009
Engage
Your Brain
www.pololu.com
RST TX RX VIN
GND

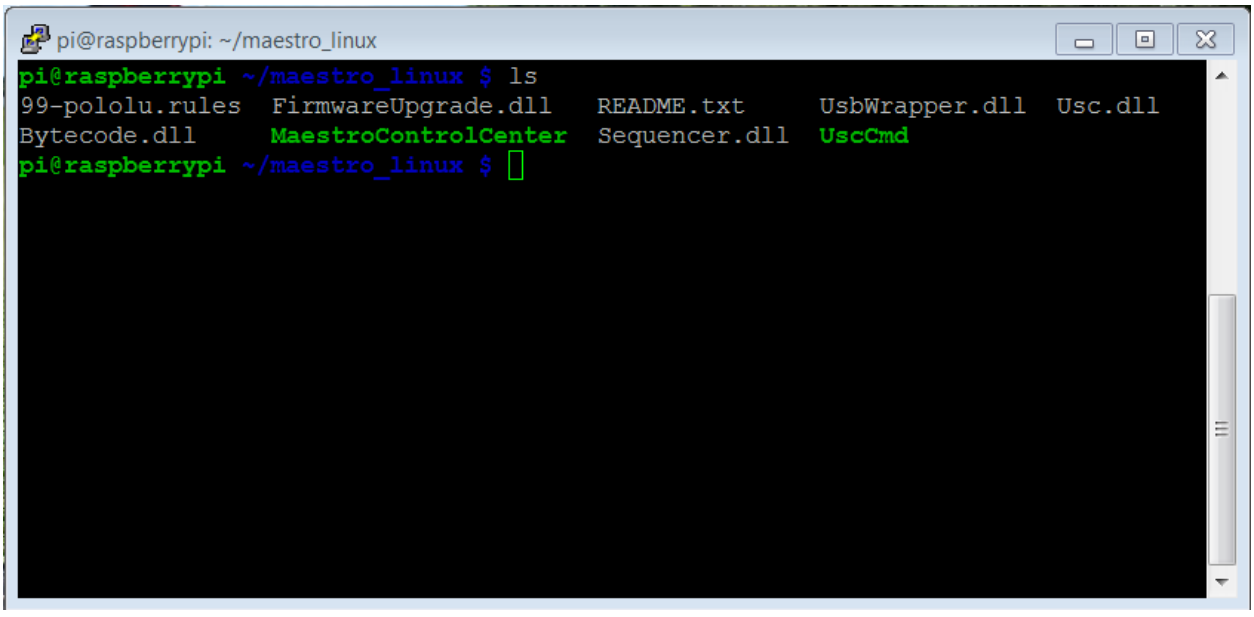

enercell

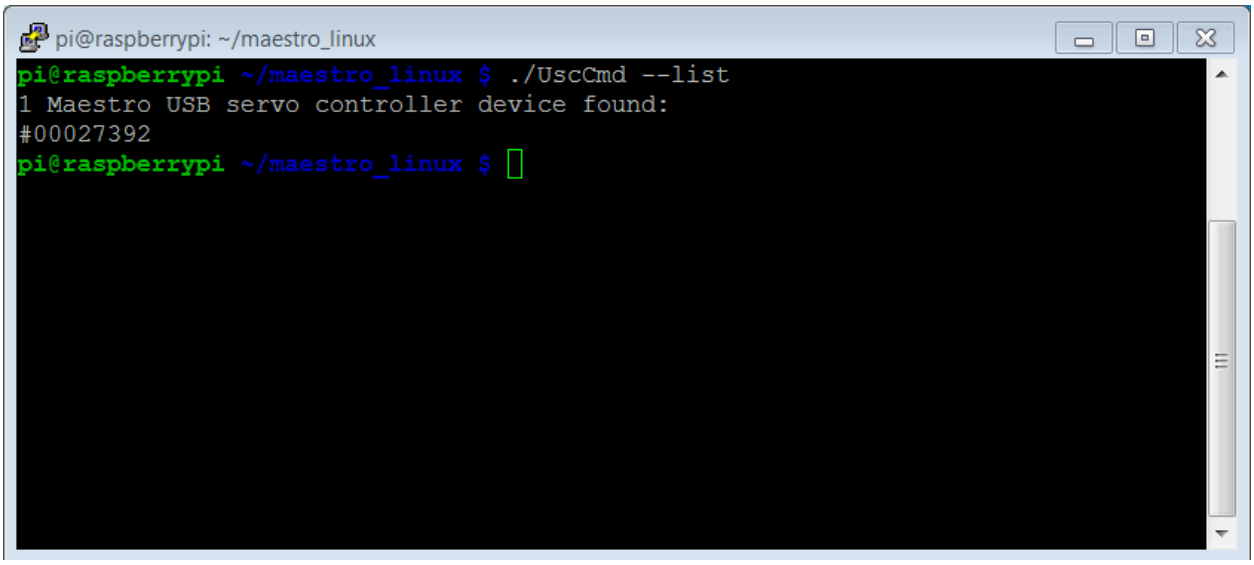

Pololu Maestro Control Center
File
Device
Edit
Help
Connected to:
#00046711
Firmware version: 1.01
Error code:
0x0000
Status
Errors
Channel Settings
Serial Settings
Sequence
Script
#
Name
Mode
Enabled
Target
Speed
Acceleration
Position
0
Servo
1500.00
0
0
0.00
1
Servo
1500.00
0
0
0.00
2
Servo
1500.00
0
0
0.00
3
Servo
1500.00
0
0
0.00
4
Servo
1500.00
0
0
0.00
5
Servo
1500.00
0
0
0.00
Save Frame 0
Apply Settings

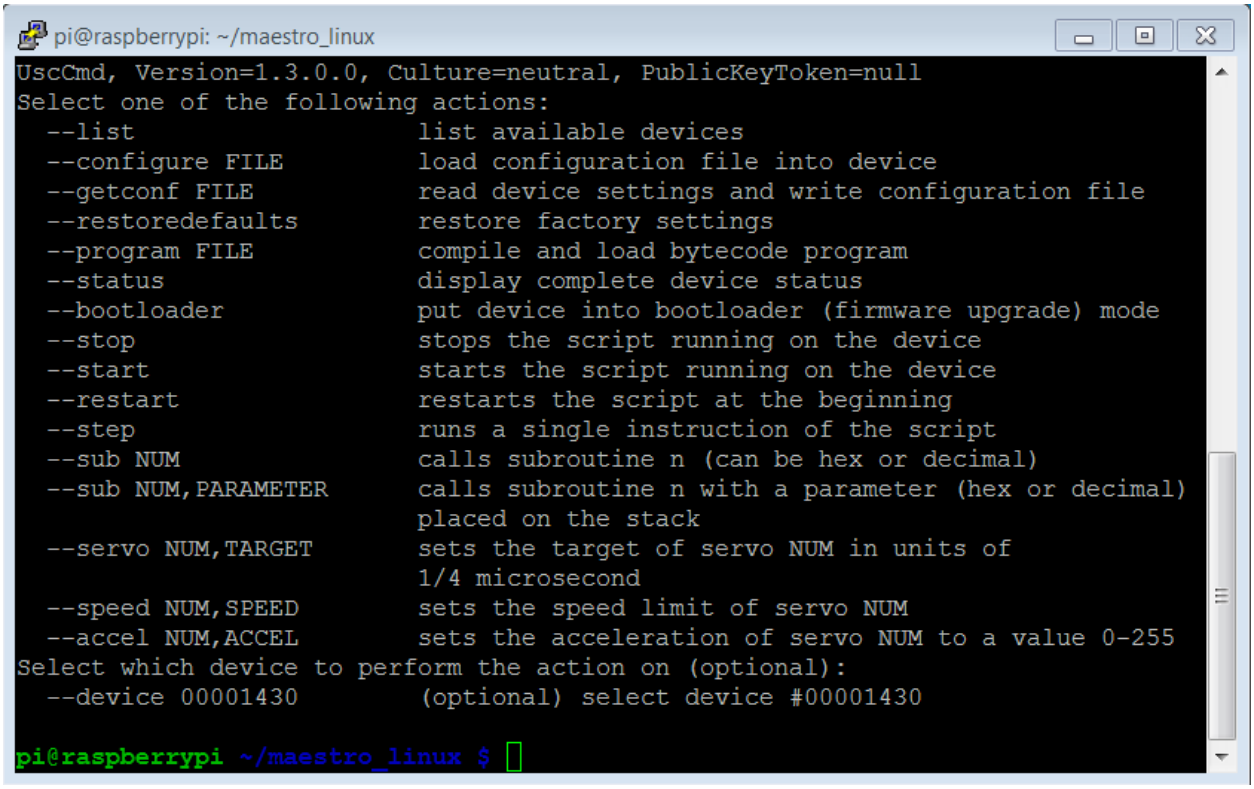

Pololu Maestro Control Center
File
Device
Edit
Help
Connected to:
#00046711
Firmware version: 1.01
Error code:
0x0000
Status
Errors
Channel Settings
Serial Settings
Sequence
Script
Serial mode:
USB Dual Port
USB Chained
UART, fixed baud rate:
9600
UART, detect baud rate
Enable CRC
Device Number:
12
Mini SSC offset:
0
Timeout (s):
0.00
Never sleep (ignore USB suspend)
Save Frame 0
Apply Settings

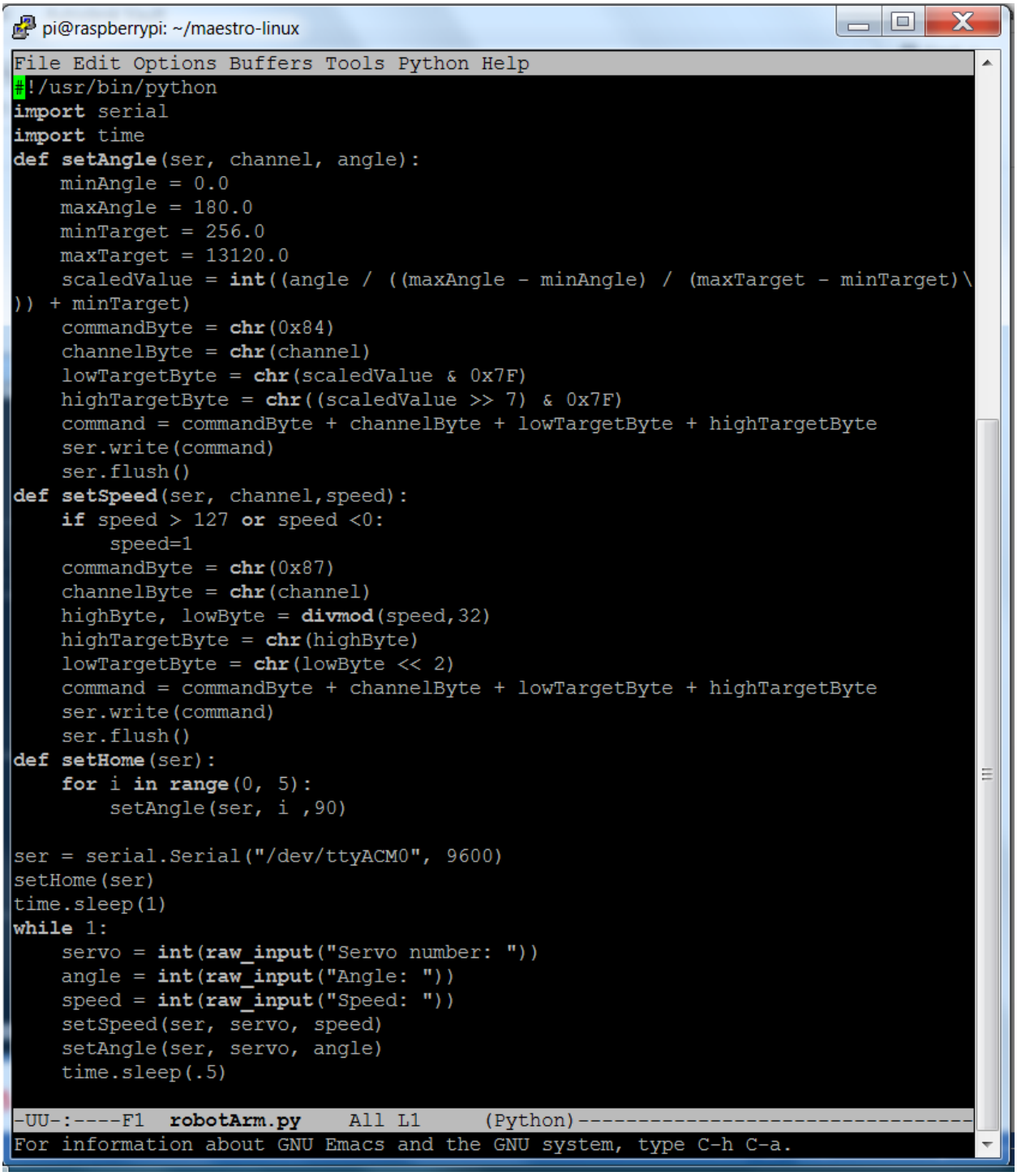

Pololu Maestro Control Center
File
Device
Edit
Help
Connected to:
#00046711
Firmware version: 1.01
Error code:
0x0000
Status
Errors
Channel Settings
Serial Settings
Sequence
Script
Name Mode Enabled Target Speed Acceleration Position
0 Servo 1500.00 0 0 1500.00
1 Servo 1500.00 0 0 1500.00
2 Servo 1500.00 0 0 1500.00
3 Servo 1500.00 0 0 1500.00
4 Servo 1500.00 0 0 0.00
5 Servo 1500.00 0 0 0.00
Save Frame 0
Apply Settings

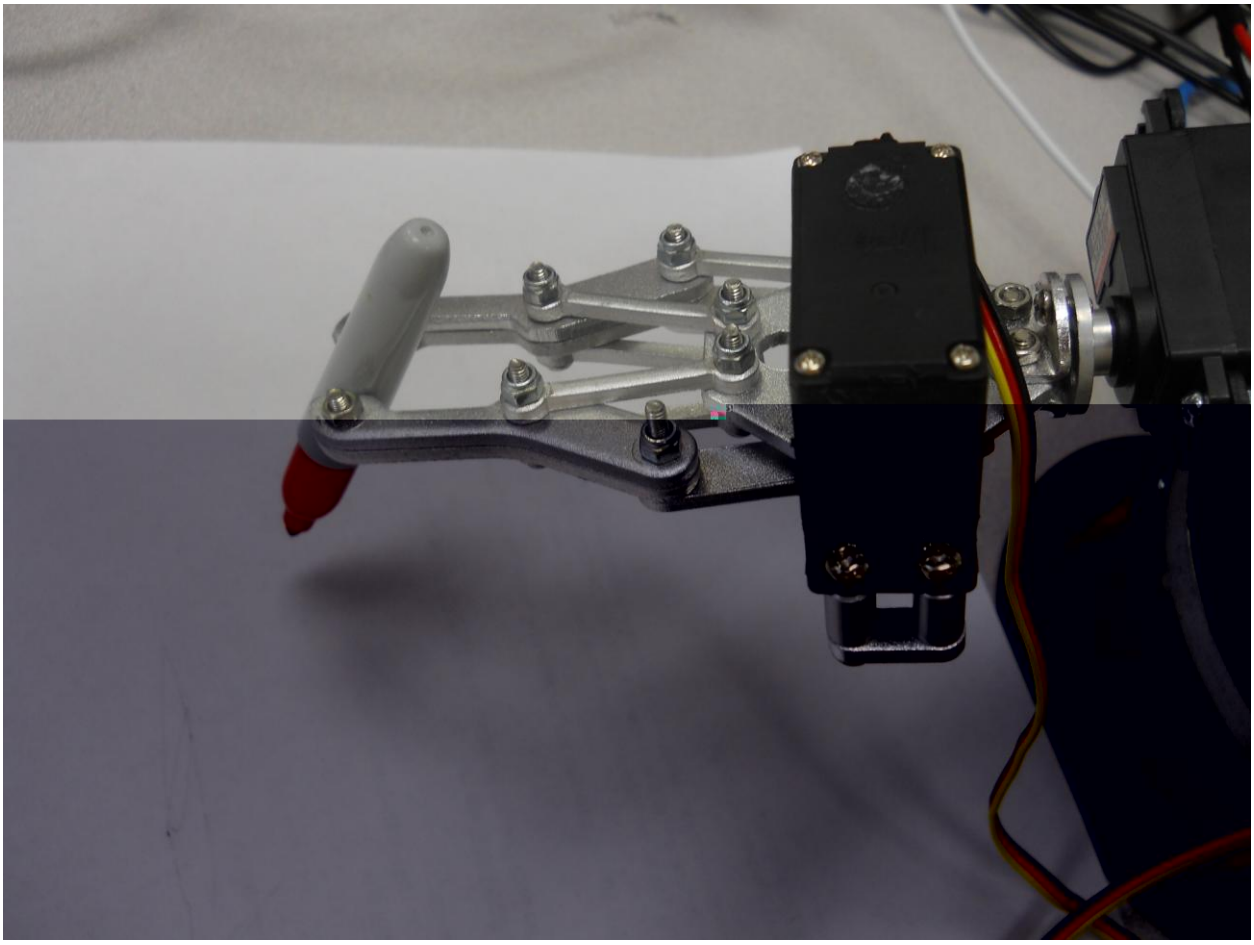


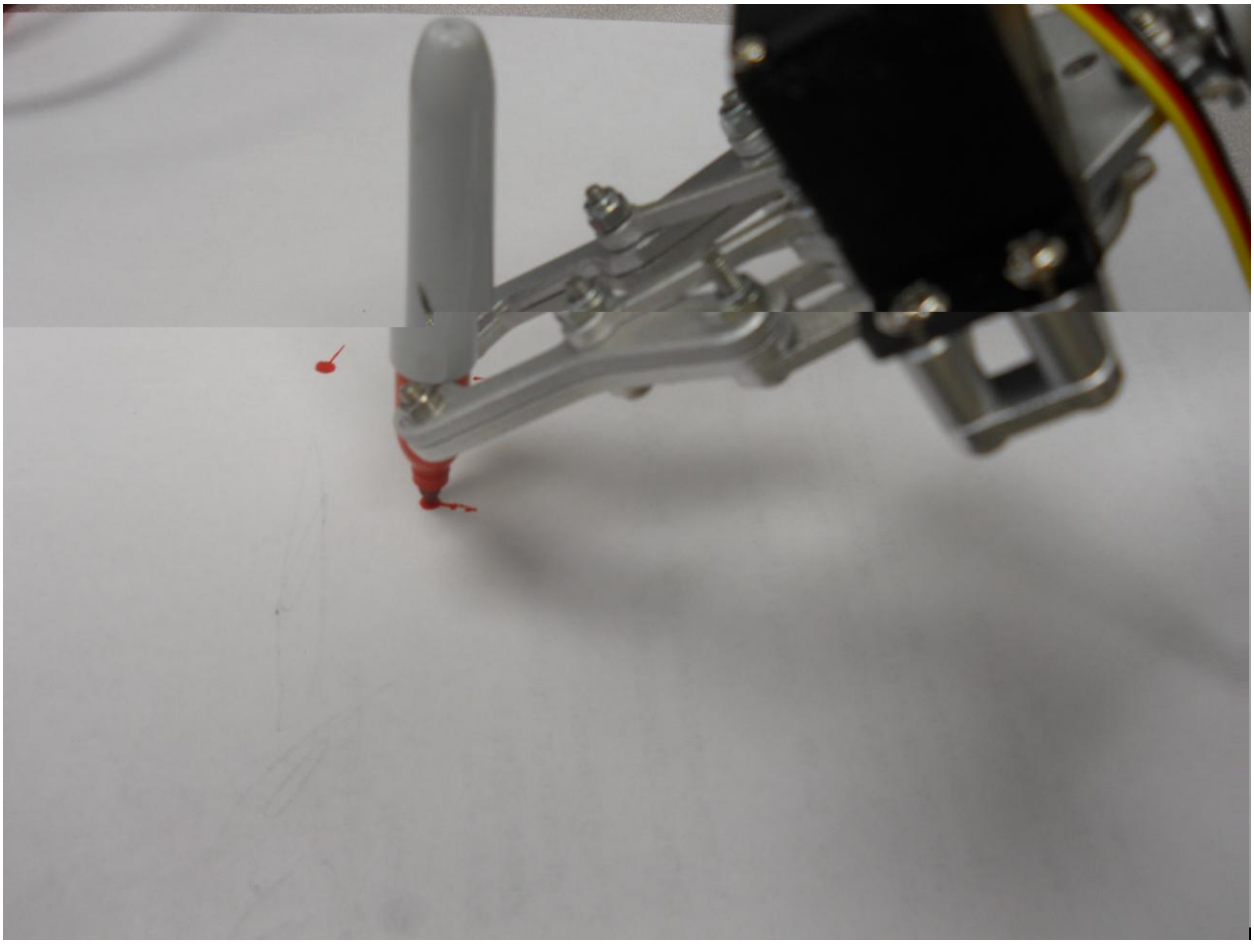

pi@raspberrypi: ~/maestro_linux
pi@raspberrypi ~/maestro_linux $ ls
99-pololu.rules FirmwareUpgrade.dll README.txt UsbWrapper.dll Usc.dll
Bytecode.dll MaestroControlCenter Sequencer.dll UscCmd
pi@raspberrypi ~/maestro_linux $

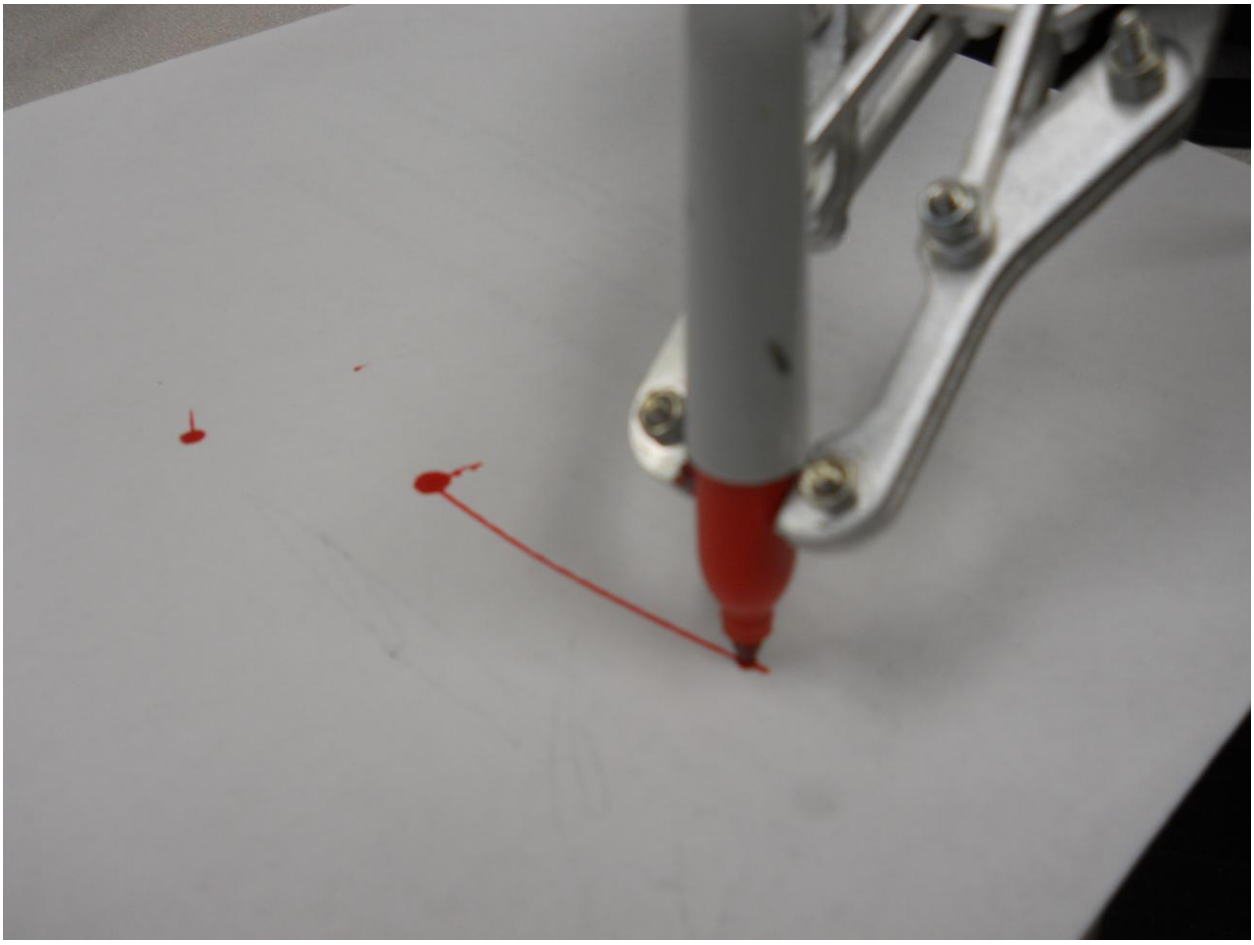

pi@raspberrypi: ~/maestro_linux
pi@raspberrypi ~/maestro_linux $ ./UscCmd --list
1 Maestro USB servo controller device found:
#00027392
pi@raspberrypi ~/maestro_linux $

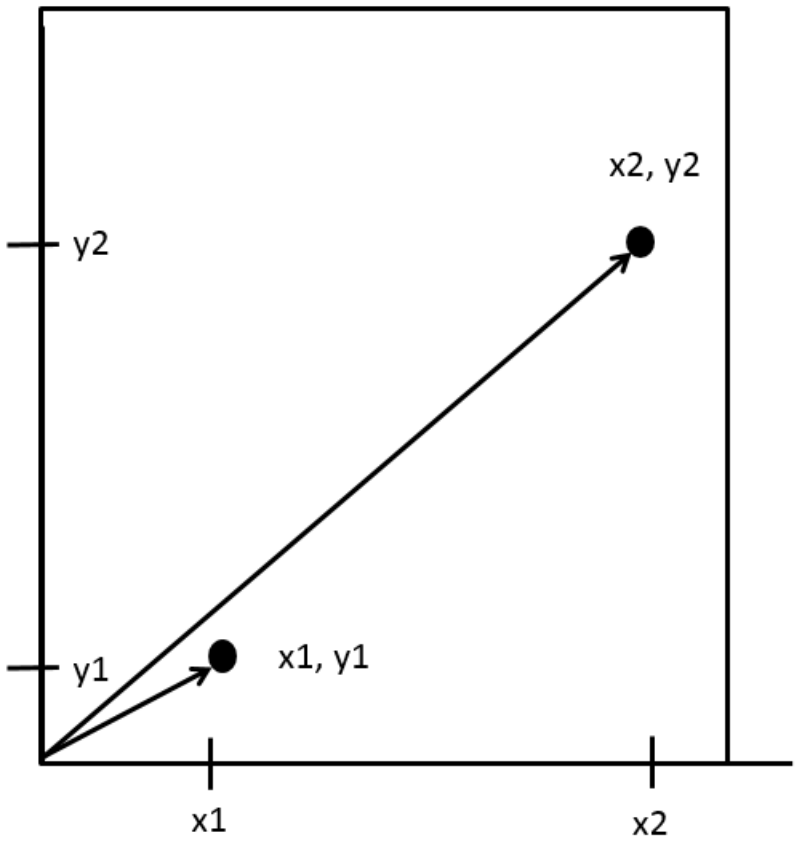

pi@raspberrypi: ~/maestro_linux
UscCmd, Version=1.3.0.0, Culture=neutral, PublicKeyToken=null
Select one of the following actions:
--list list available devices
--configure FILE load configuration file into device
--getconf FILE read device settings and write configuration file
--restoredefaults restore factory settings
--program FILE compile and load bytecode program
--status display complete device status
--bootloader put device into bootloader (firmware upgrade) mode
--stop stops the script running on the device
--start starts the script running on the device
--restart restarts the script at the beginning
--step runs a single instruction of the script
--sub NUM calls subroutine n (can be hex or decimal)
--sub NUM,PARAMETER calls subroutine n with a parameter (hex or decimal)
placed on the stack
--servo NUM,TARGET sets the target of servo NUM in units of
1/4 microsecond
--speed NUM,SPEED sets the speed limit of servo NUM
--accel NUM,ACCEL sets the acceleration of servo NUM to a value 0-255
Select which device to perform the action on (optional):
--device 00001430 (optional) select device #00001430
pi@raspberrypi ~/maestro_linux $


pi@raspberrypi: ~/maestro-linux
File Edit Options Buffers Tools Python Help
#!/usr/bin/python
import serial
import time
def setAngle(ser, channel, angle):
minAngle = 0.0
maxAngle = 180.0
minTarget = 256.0
maxTarget = 13120.0
scaledValue = int((angle / ((maxAngle - minAngle) / (maxTarget - minTarget)\
)) + minTarget)
commandByte = chr(0x84)
channelByte = chr(channel)
lowTargetByte = chr(scaledValue & 0x7F)
highTargetByte = chr((scaledValue >> 7) & 0x7F)
command = commandByte + channelByte + lowTargetByte + highTargetByte
ser.write(command)
ser.flush()
def setSpeed(ser, channel,speed):
if speed > 127 or speed <0:
speed=1
commandByte = chr(0x87)
channelByte = chr(channel)
highByte, lowByte = divmod(speed,32)
highTargetByte = chr(highByte)
lowTargetByte = chr(lowByte << 2)
command = commandByte + channelByte + lowTargetByte + highTargetByte
ser.write(command)
ser.flush()
def setHome(ser):
for i in range(0, 5):
setAngle(ser, i ,90)
ser = serial.Serial("/dev/ttyACM0", 9600)
setHome(ser)
time.sleep(1)
while 1:
servo = int(raw_input("Servo number: "))
angle = int(raw_input("Angle: "))
speed = int(raw_input("Speed: "))
setSpeed(ser, servo, speed)
setAngle(ser, servo, angle)
time.sleep(.5)
-UU-:----F1 robotArm.py All L1 (Python)
For information about GNU Emacs and the GNU system, type C-h C-a.

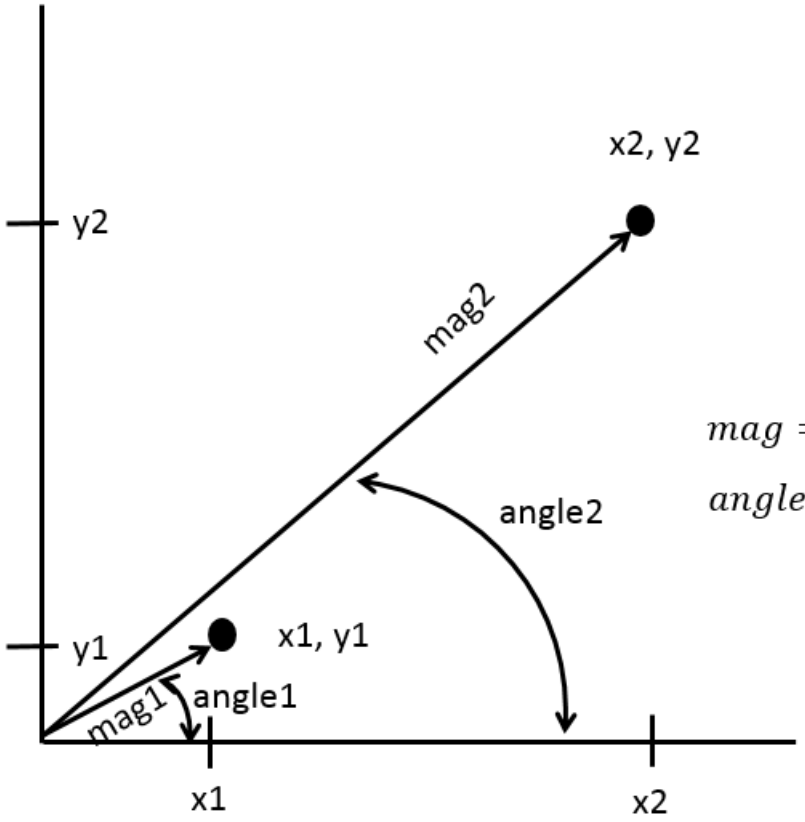







x2, y2
y2
y1
x1, y1
x1
x2

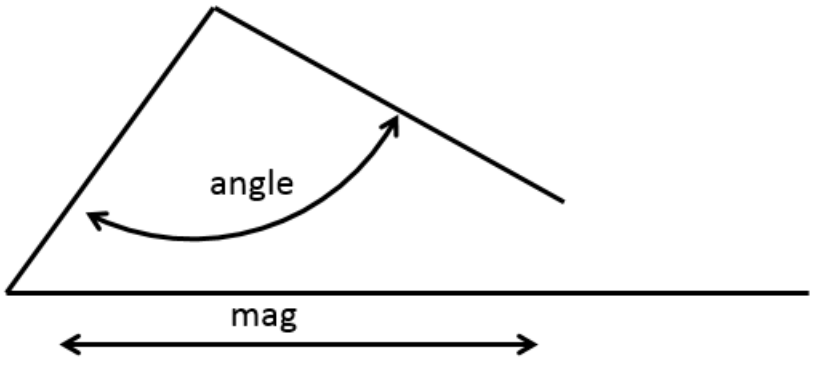
y = mag*sin(angle)



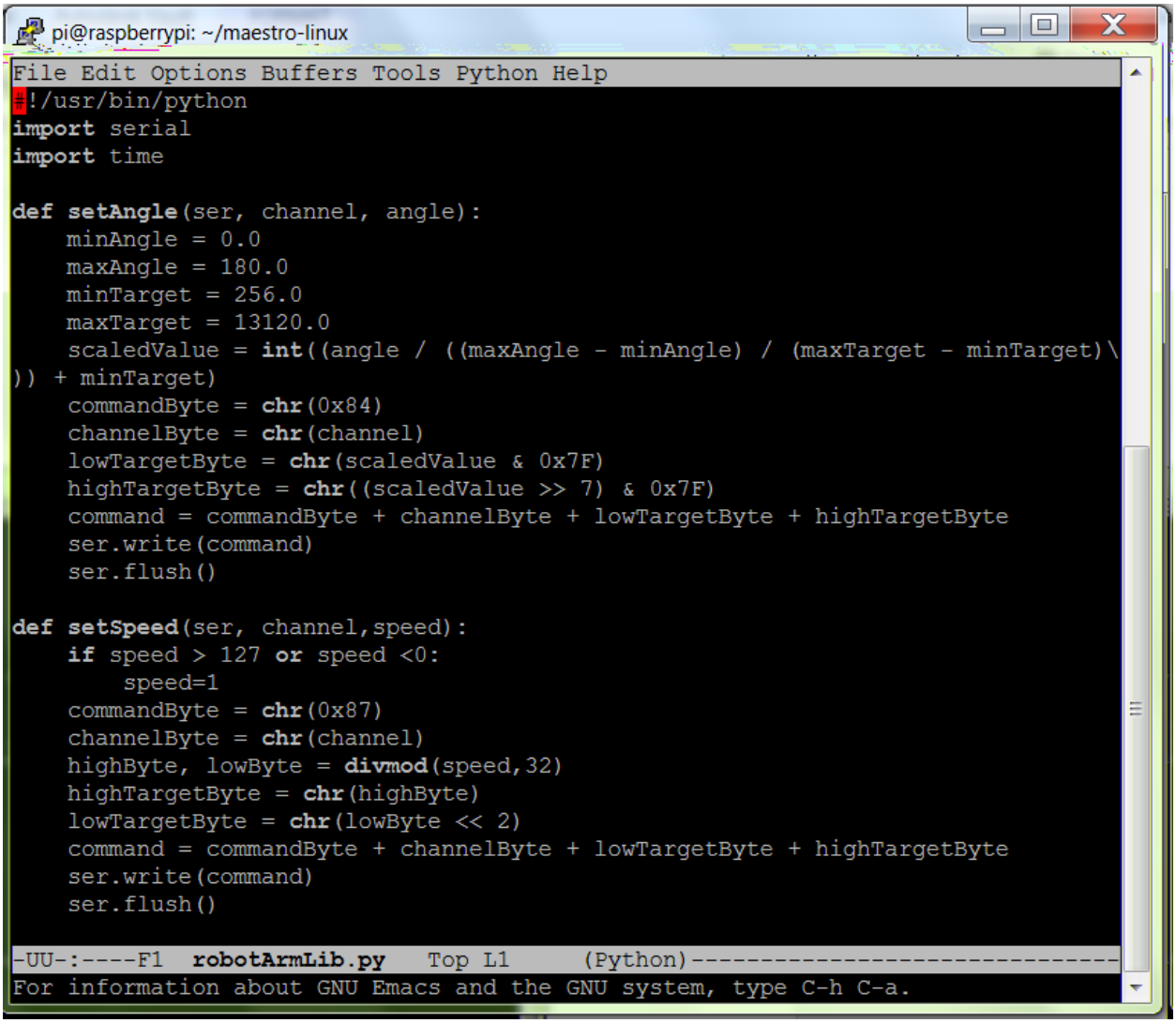
$$mag = \sqrt{(x^2 + y^2)}$$

$$angle = \arctan(\frac{y}{x})$$

x = mag*cos(angle)



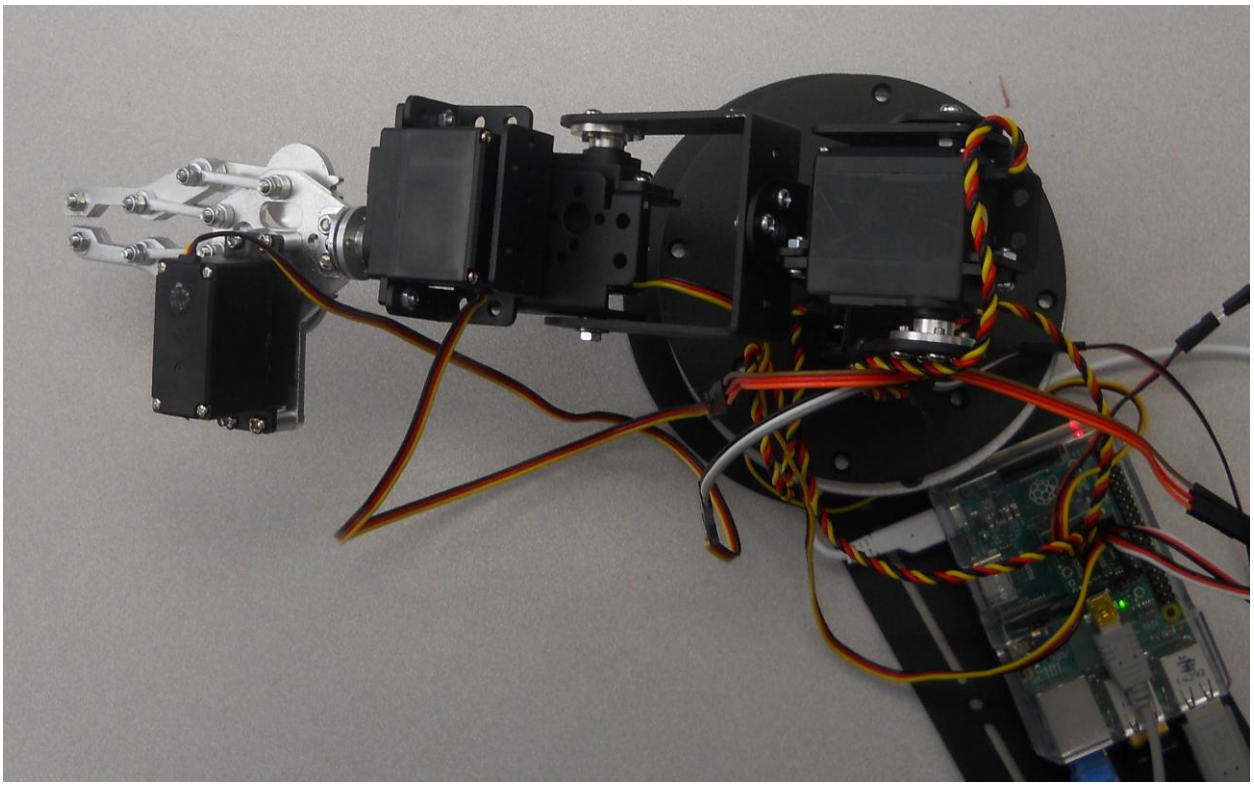
mag = maxLength*sin(angle)

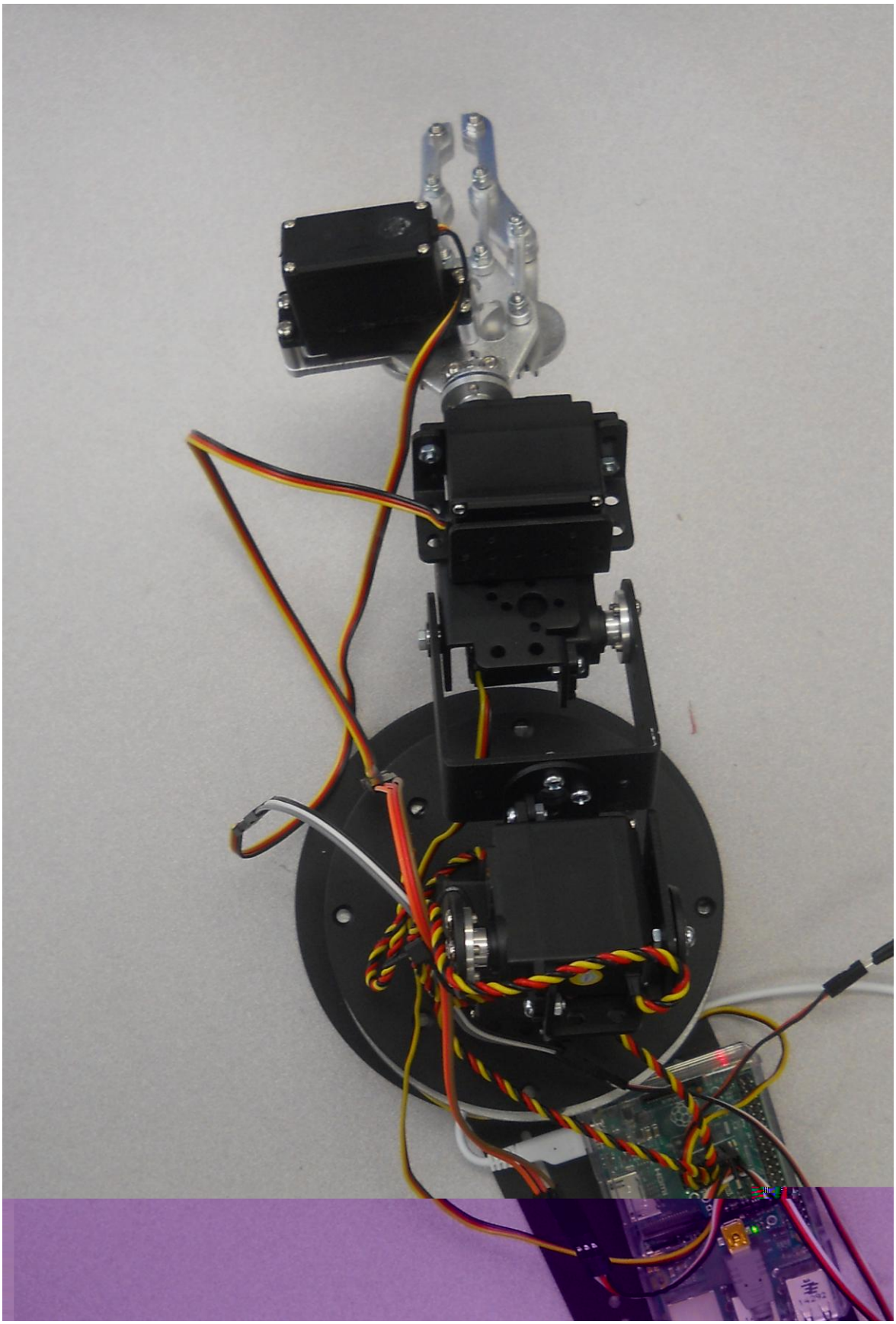

pi@raspberrypi: ~/maestro-linux
File Edit Options Buffers Tools Python Help
#!/usr/bin/python
import serial
import time
def setAngle(ser, channel, angle):
minAngle = 0.0
maxAngle = 180.0
minTarget = 256.0
maxTarget = 13120.0
scaledValue = int((angle / ((maxAngle - minAngle) / (maxTarget - minTarget)\
)) + minTarget)
commandByte = chr(0x84)
channelByte = chr(channel)
lowTargetByte = chr(scaledValue & 0x7F)
highTargetByte = chr((scaledValue >> 7) & 0x7F)
command = commandByte + channelByte + lowTargetByte + highTargetByte
ser.write(command)
ser.flush()
def setSpeed(ser, channel,speed):
if speed > 127 or speed <0:
speed=1
commandByte = chr(0x87)
channelByte = chr(channel)
highByte, lowByte = divmod(speed,32)
highTargetByte = chr(highByte)
lowTargetByte = chr(lowByte << 2)
command = commandByte + channelByte + lowTargetByte + highTargetByte
ser.write(command)
ser.flush()
-UU-:----F1 robotArmLib.py Top L1 (Python)----------
For information about GNU Emacs and the GNU system, type C-h C-a.

pi@raspberrypi: ~/maestro-linux

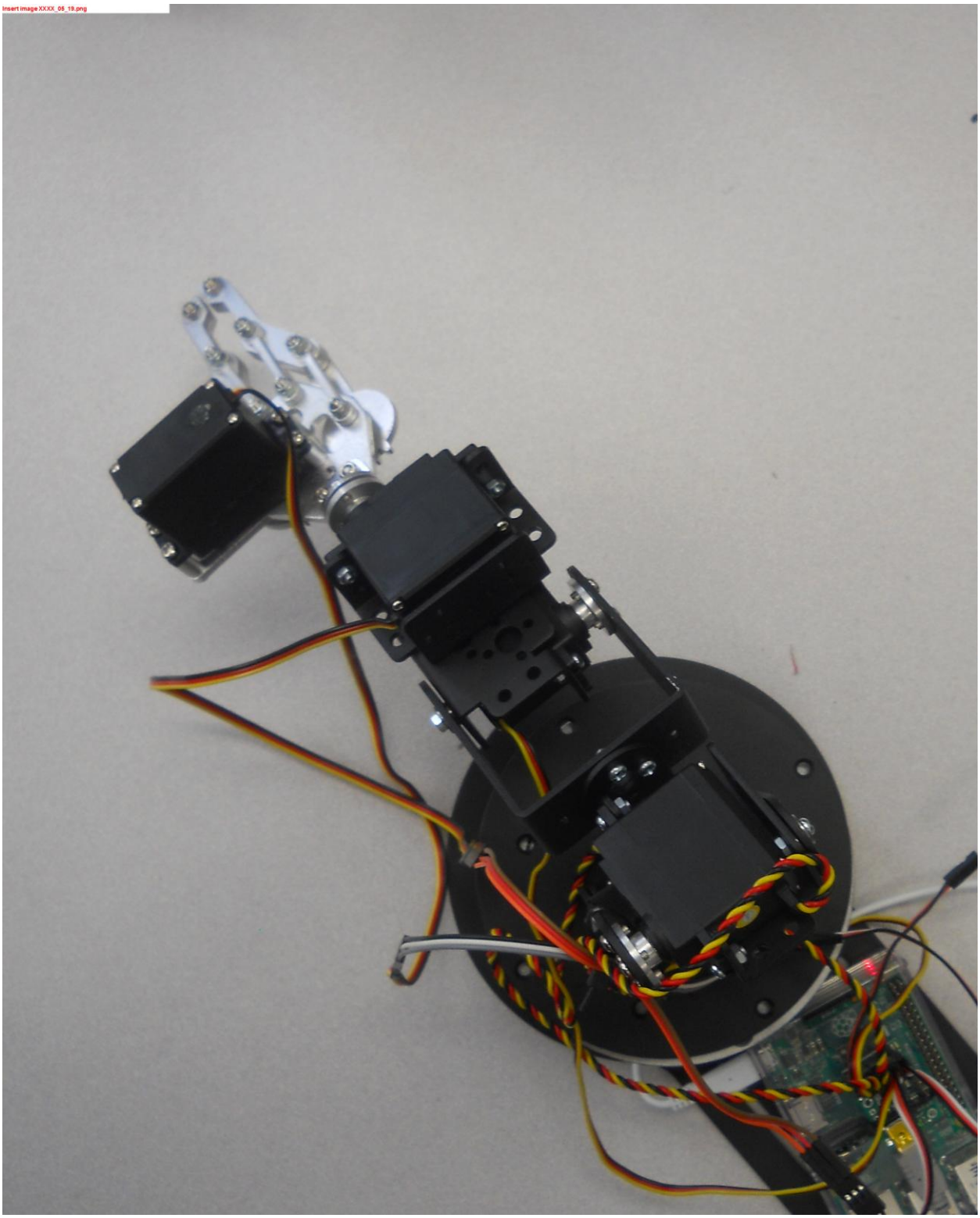
```
File Edit Options Buffers Tools Python Help
#!/usr/bin/python
import serial
import time
import math
from robotArmLib import *

ser = serial.Serial("/dev/ttyACM0", 9600)

while 1:
    x = int(raw_input("x: "))
    y = int(raw_input("y: "))
    speed = 5
    servo0 = 0
    setSpeed(ser, servo0, speed)
    angle = int((math.atan2(y, x)* 360)/(2 * 3.1416))
    print angle
    setAngle(ser, servo0, angle + 40)
```

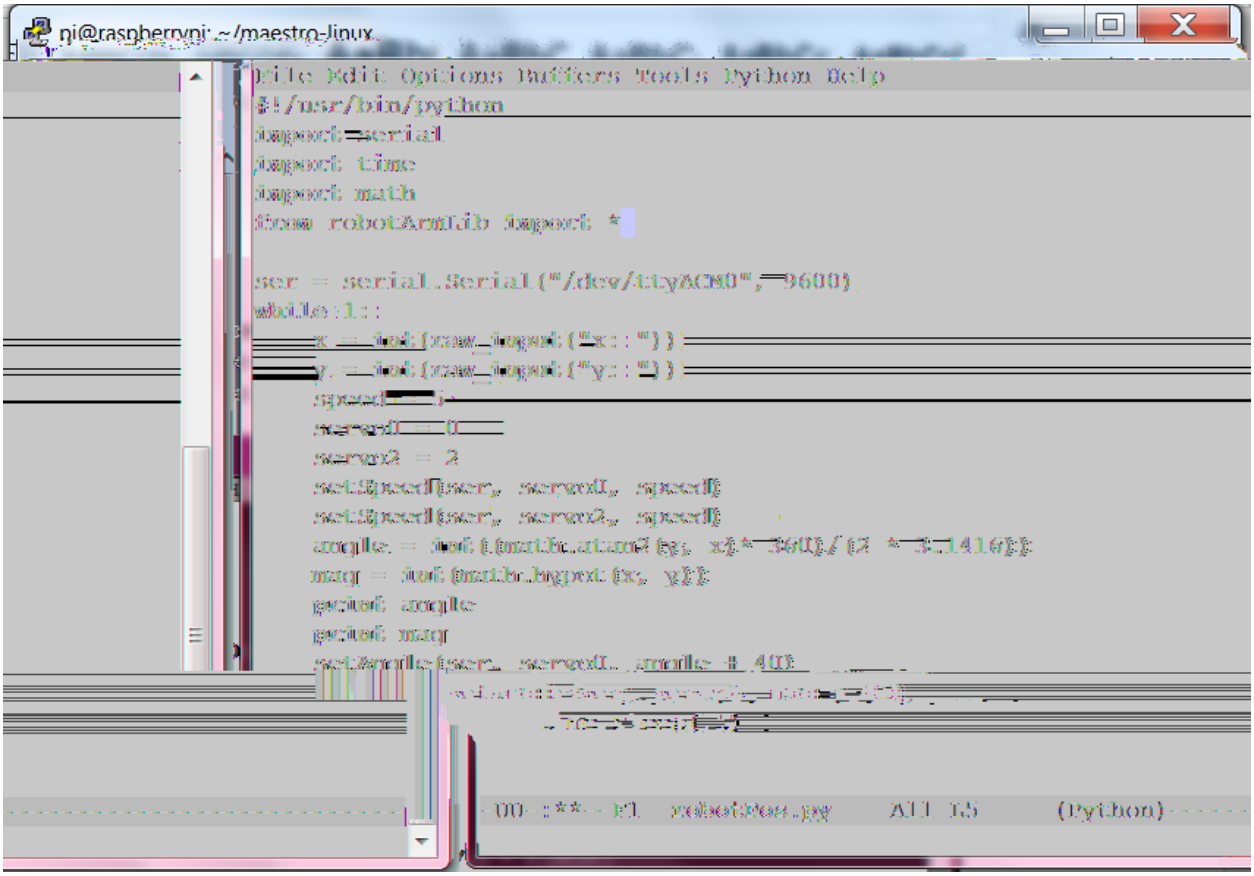
-UU-:**--F1 **robotPos.py** All L18 (Python)----------

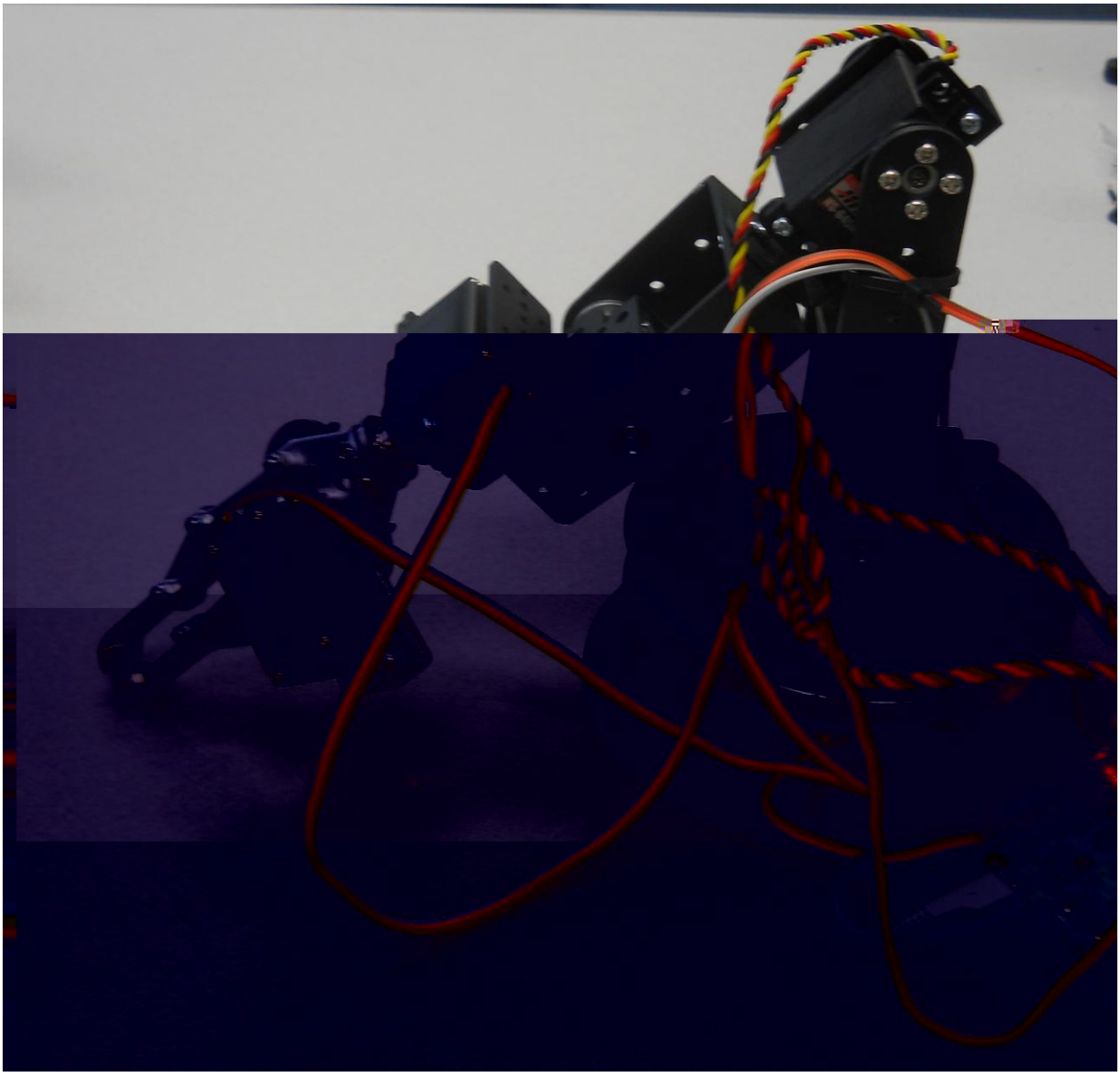


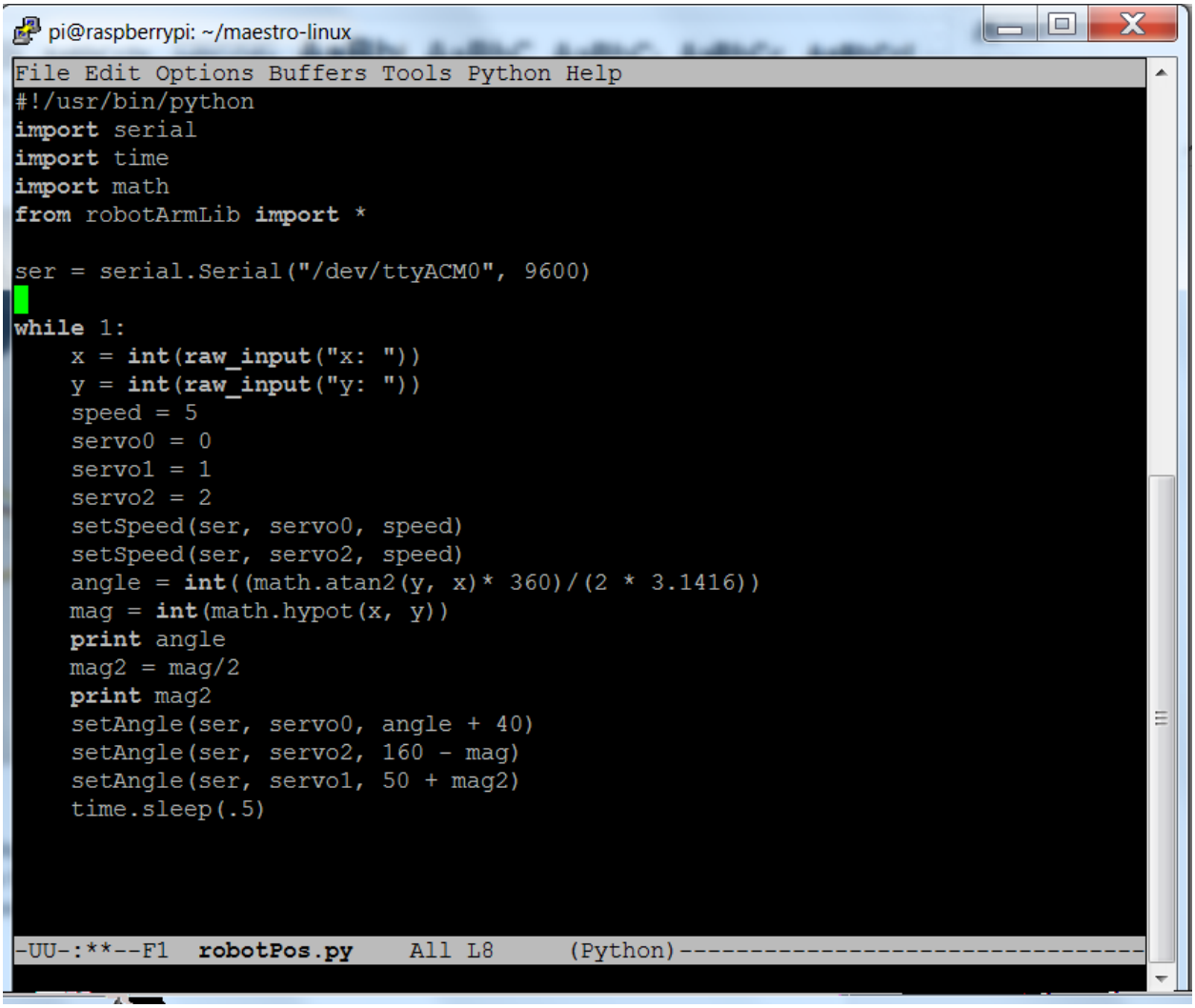


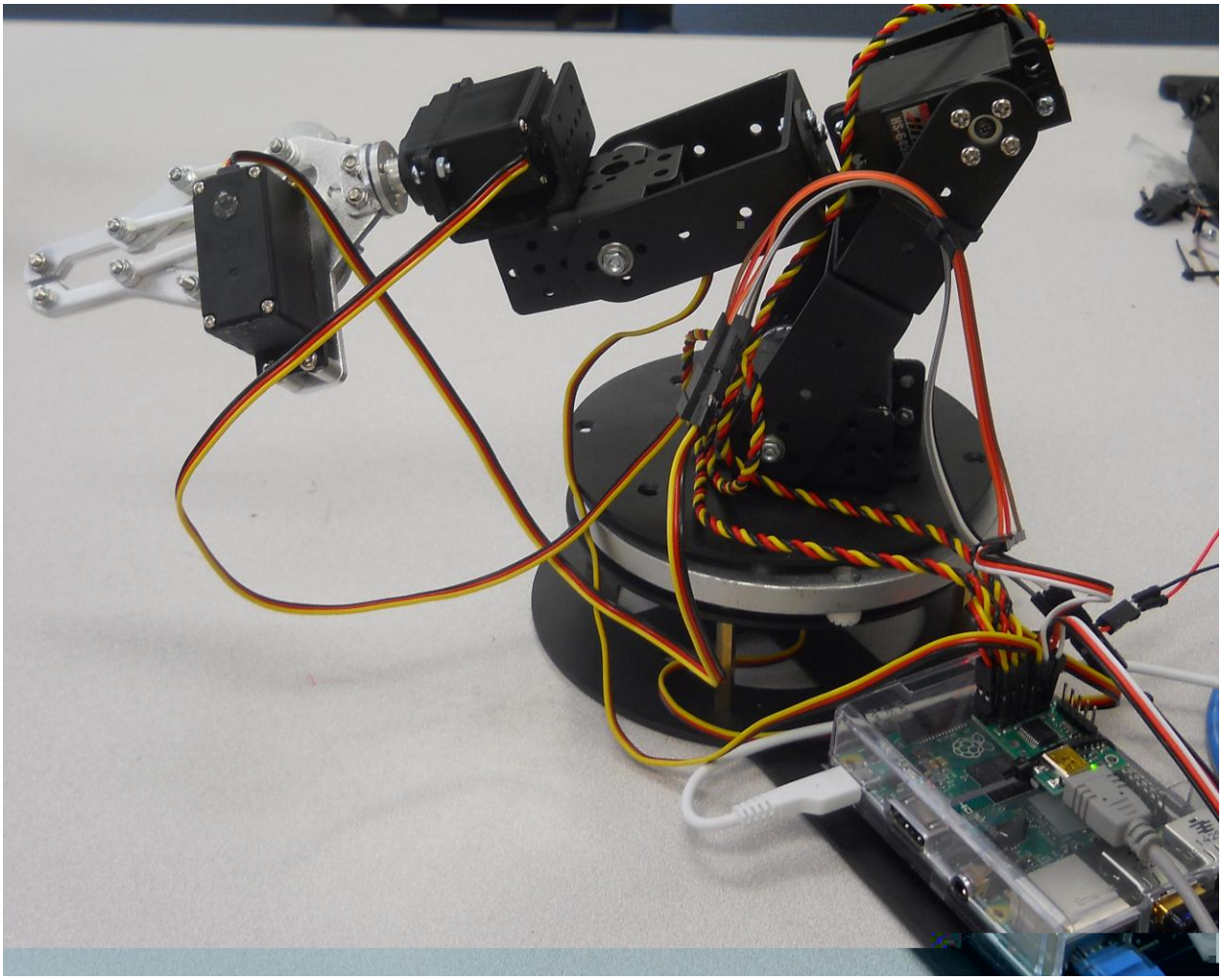
Insert image XXXX_05_19.png

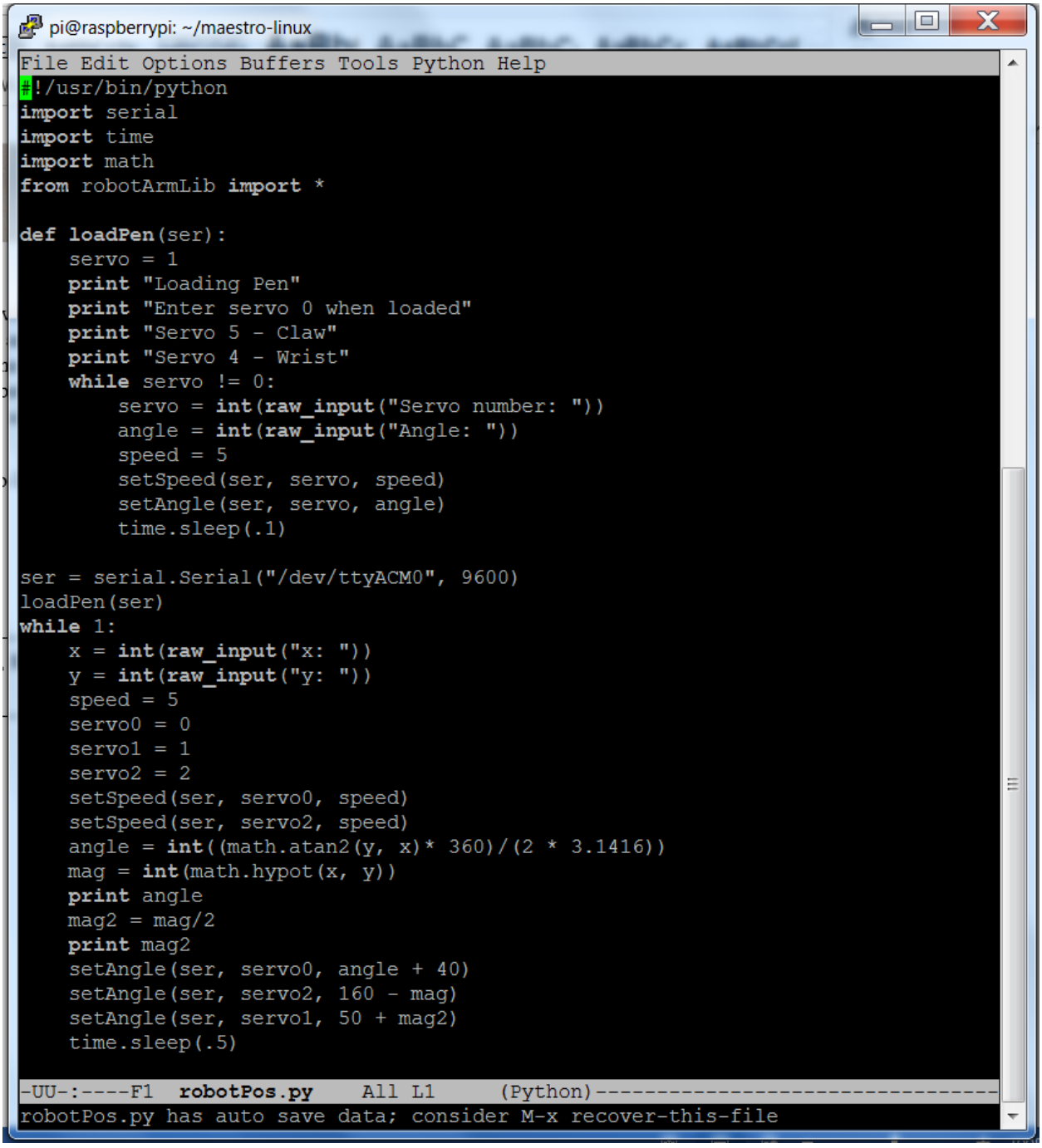


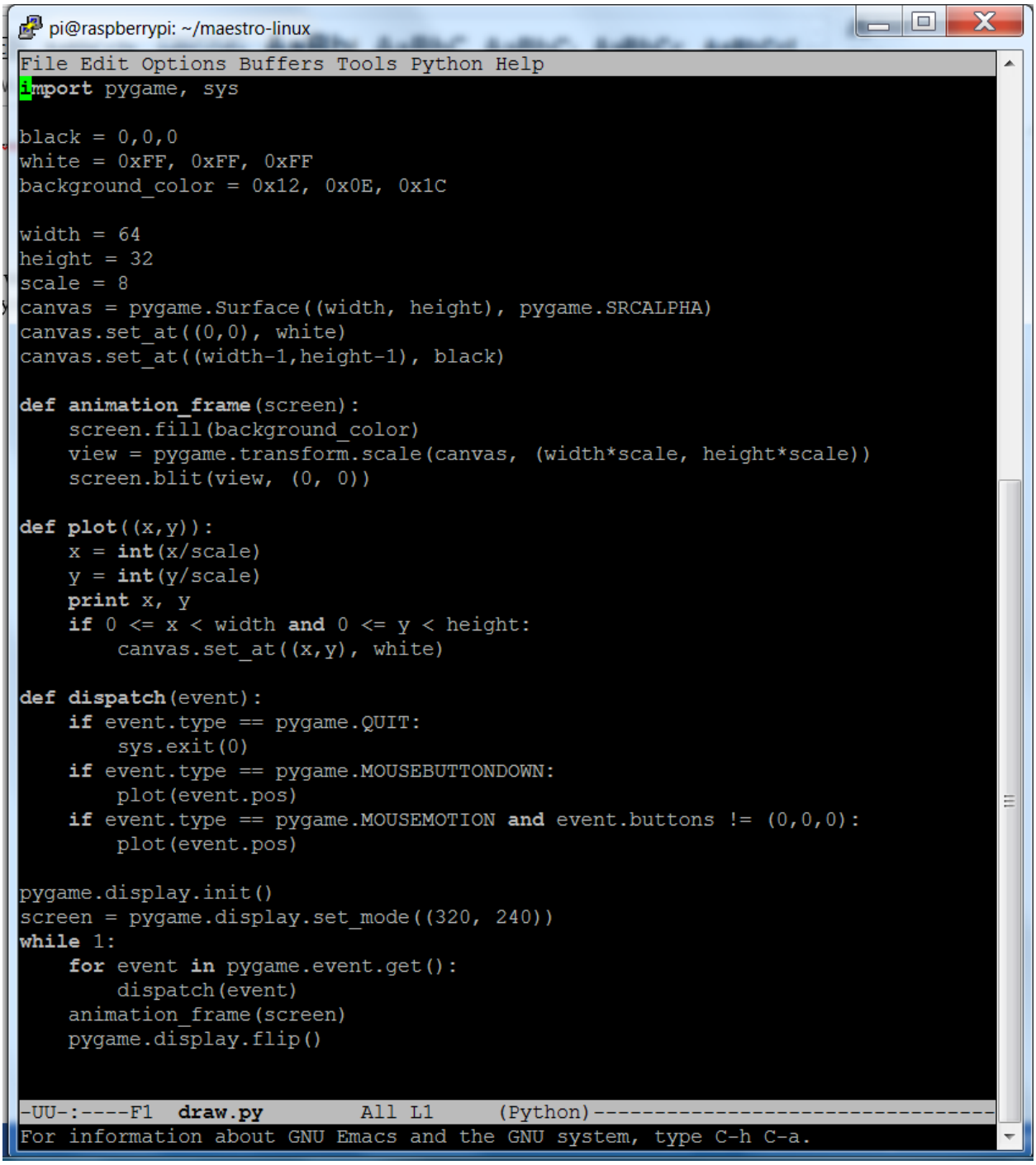

pi@raspberrypi: ~/maestro-linux
File Edit Options Buffers Tools Python Help
#!/usr/bin/python
import serial
import time
import math
from robotArmLib import *
ser = serial.Serial("/dev/ttyACM0",9600)
while 1:
x = int(raw_input("x: "))
y = int(raw_input("y: "))
speed=5
servo1=0
servo2 = 2
setSpeed(ser, servo1, speed)
setSpeed(ser, servo2, speed)
angle = int(math.atan2(x, y*-360/(2 *3.1416)))
mag = int(math.hypot(x, y))
print angle
print mag
setAngle(ser, servo1, angle, 0.40)
00 -:***- P1 robotPos.py All L5 (Python)

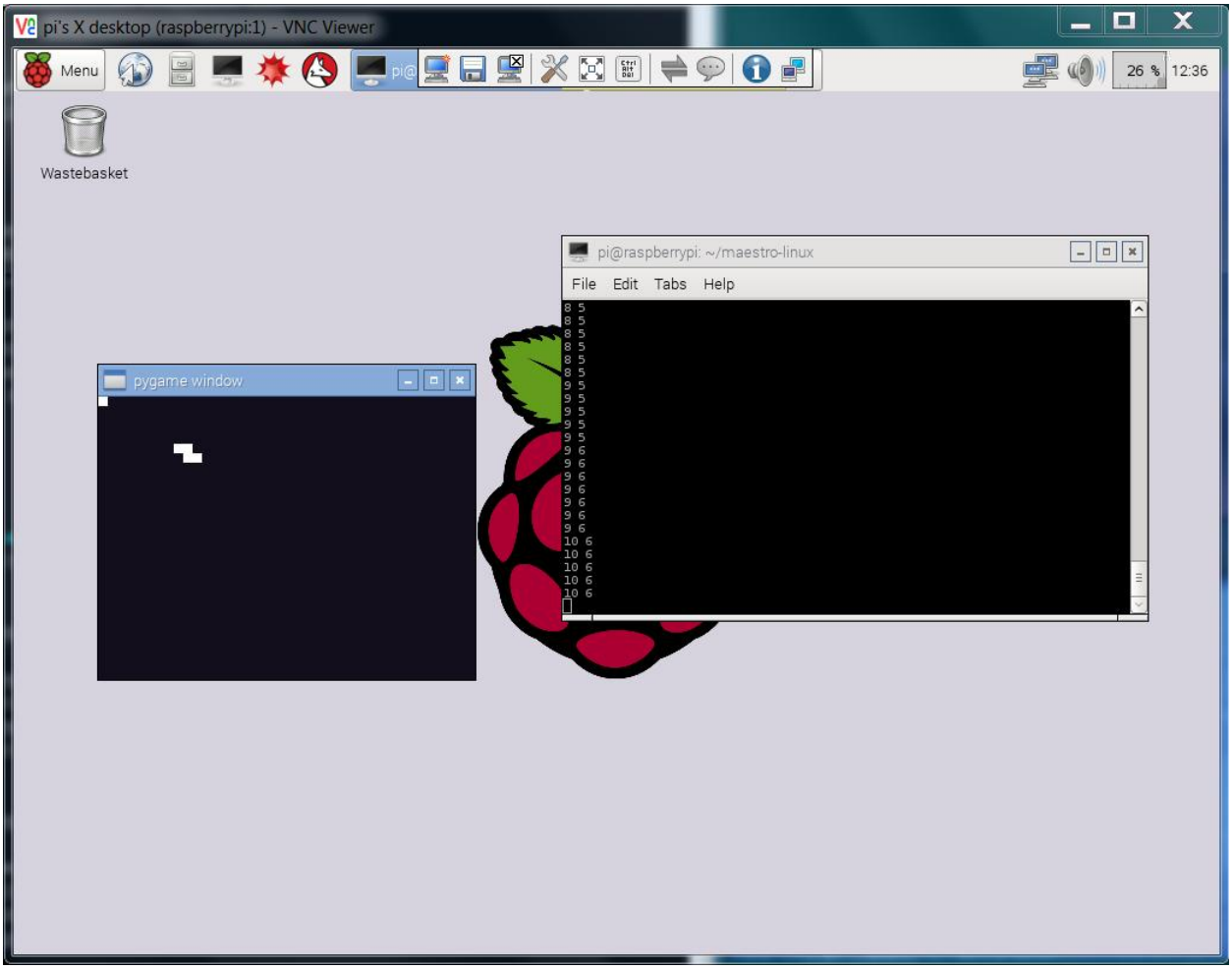



pi@raspberrypi: ~/maestro-linux
File Edit Options Buffers Tools Python Help
#!/usr/bin/python
import serial
import time
import math
from robotArmLib import *
ser = serial.Serial("/dev/ttyACM0", 9600)
while 1:
x = int(raw_input("x: "))
y = int(raw_input("y: "))
speed = 5
servo0 = 0
servo1 = 1
servo2 = 2
setSpeed(ser, servo0, speed)
setSpeed(ser, servo2, speed)
angle = int((math.atan2(y, x)* 360)/(2 * 3.1416))
mag = int(math.hypot(x, y))
print angle
mag2 = mag/2
print mag2
setAngle(ser, servo0, angle + 40)
setAngle(ser, servo2, 160 - mag)
setAngle(ser, servo1, 50 + mag2)
time.sleep(.5)
-UU-:**--F1 robotPos.py All L8 (Python)




pi@raspberrypi: ~/maestro-linux
File Edit Options Buffers Tools Python Help
#!/usr/bin/python
import serial
import time
import math
from robotArmLib import *
def loadPen(ser):
servo = 1
print "Loading Pen"
print "Enter servo 0 when loaded"
print "Servo 5 - Claw"
print "Servo 4 - Wrist"
while servo != 0:
servo = int(raw_input("Servo number: "))
angle = int(raw_input("Angle: "))
speed = 5
setSpeed(ser, servo, speed)
setAngle(ser, servo, angle)
time.sleep(.1)
ser = serial.Serial("/dev/ttyACM0", 9600)
loadPen(ser)
while 1:
x = int(raw_input("x: "))
y = int(raw_input("y: "))
speed = 5
servo0 = 0
servo1 = 1
servo2 = 2
setSpeed(ser, servo0, speed)
setSpeed(ser, servo2, speed)
angle = int((math.atan2(y, x)* 360)/(2 * 3.1416))
mag = int(math.hypot(x, y))
print angle
mag2 = mag/2
print mag2
setAngle(ser, servo0, angle + 40)
setAngle(ser, servo2, 160 - mag)
setAngle(ser, servo1, 50 + mag2)
time.sleep(.5)
-UU-:----F1 robotPos.py All L1 (Python)
robotPos.py has auto save data; consider M-x recover-this-file


pi@raspberrypi: ~/maestro-linux
File Edit Options Buffers Tools Python Help
import pygame, sys
black = 0,0,0
white = 0xFF, 0xFF, 0xFF
background_color = 0x12, 0x0E, 0x1C
width = 64
height = 32
scale = 8
canvas = pygame.Surface((width, height), pygame.SRCALPHA)
canvas.set_at((0,0), white)
canvas.set_at((width-1,height-1), black)
def animation_frame(screen):
screen.fill(background_color)
view = pygame.transform.scale(canvas, (width*scale, height*scale))
screen.blit(view, (0, 0))
def plot((x,y)):
x = int(x/scale)
y = int(y/scale)
print x, y
if 0 <= x < width and 0 <= y < height:
canvas.set_at((x,y), white)
def dispatch(event):
if event.type == pygame.QUIT:
sys.exit(0)
if event.type == pygame.MOUSEBUTTONDOWN:
plot(event.pos)
if event.type == pygame.MOUSEMOTION and event.buttons != (0,0,0):
plot(event.pos)
pygame.display.init()
screen = pygame.display.set_mode((320, 240))
while 1:
for event in pygame.event.get():
dispatch(event)
animation_frame(screen)
pygame.display.flip()
-UU-:----F1 draw.py All L1 (Python)
For information about GNU Emacs and the GNU system, type C-h C-a.


pi's X desktop (raspberrypi:1) - VNC Viewer
Menu
26 %
12:36
Wastebasket
pygame window
pi@raspberrypi: ~/maestro-linux
File Edit Tabs Help
8 5
8 5
8 5
8 5
8 5
8 5
9 5
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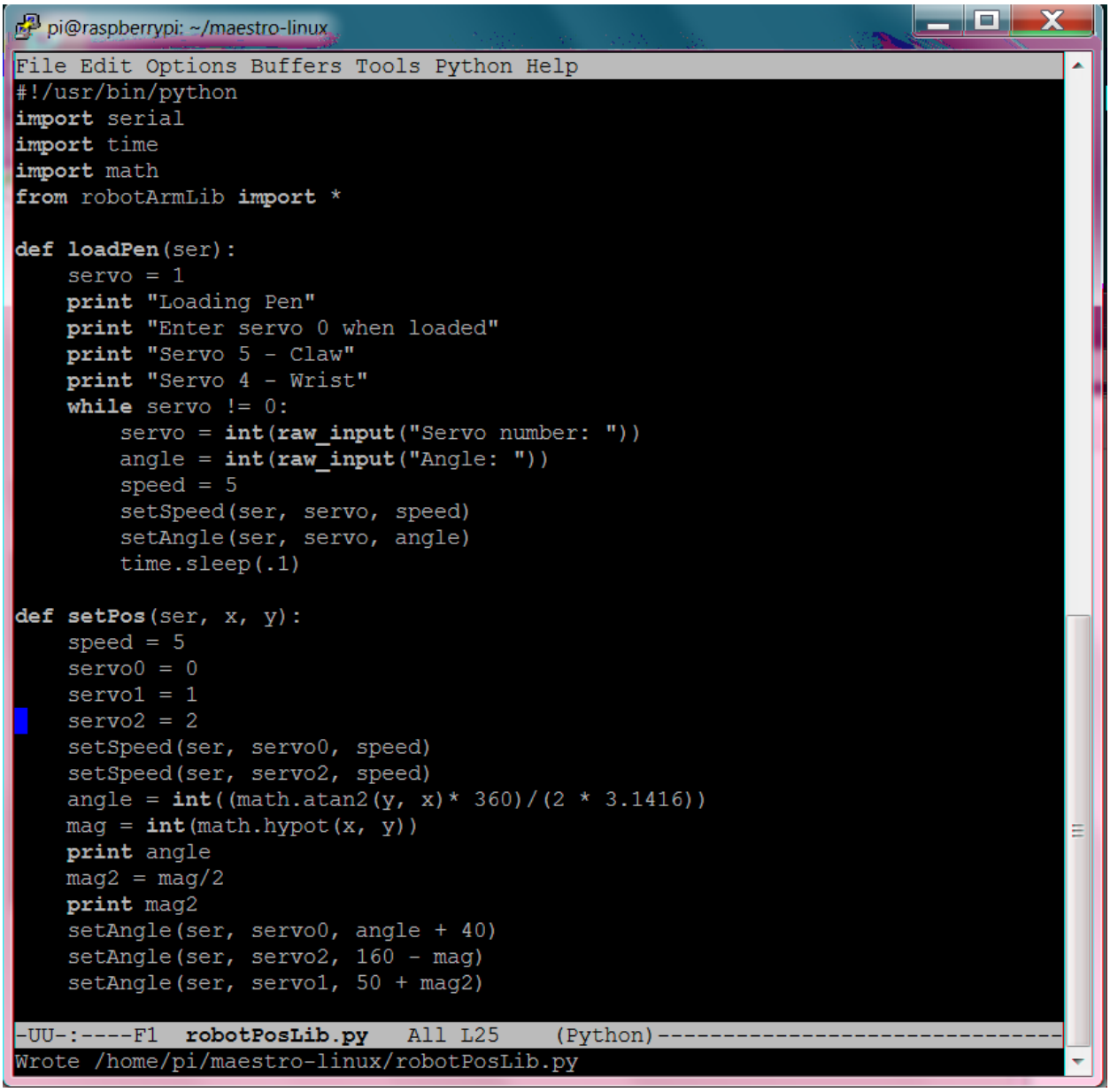
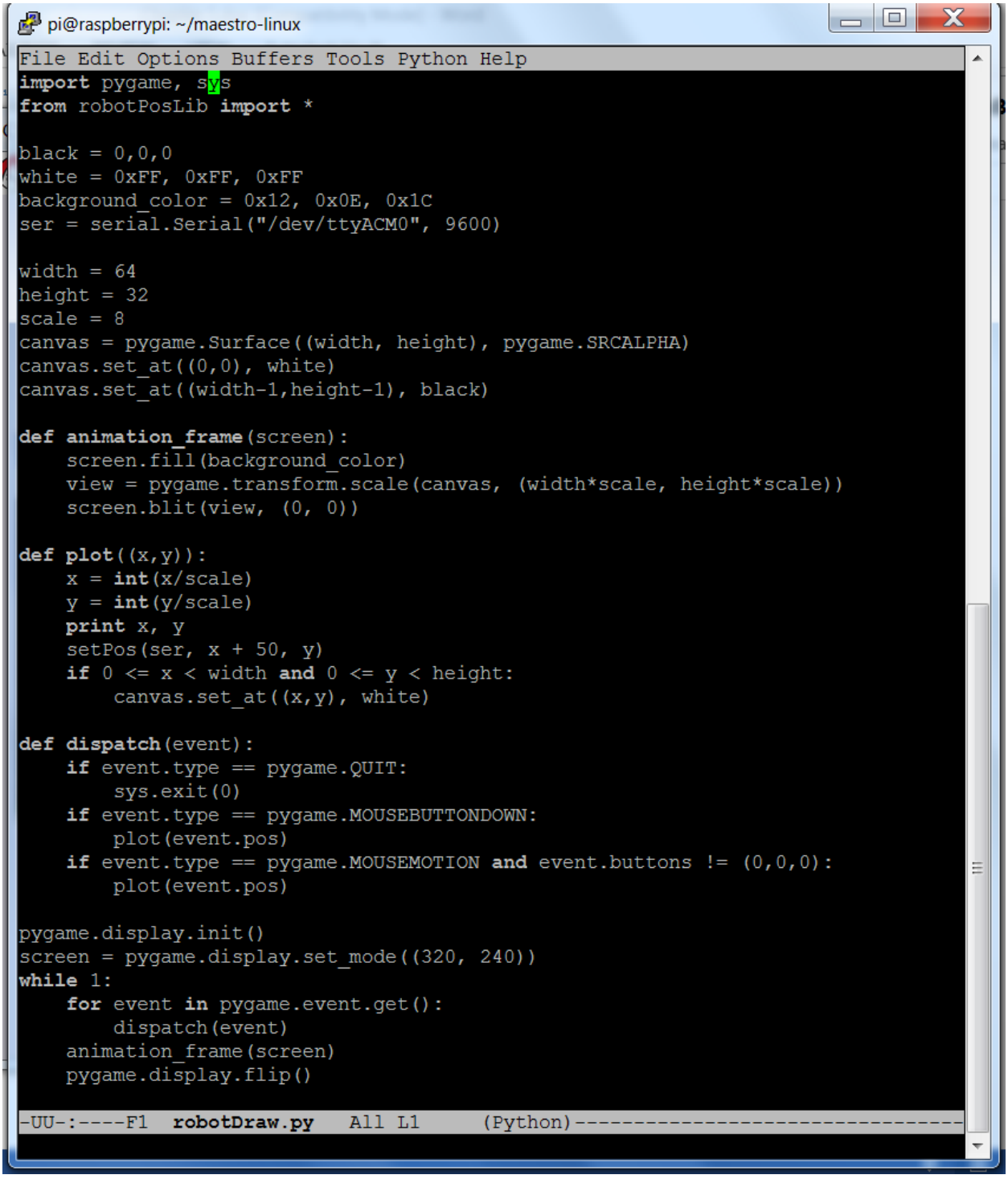
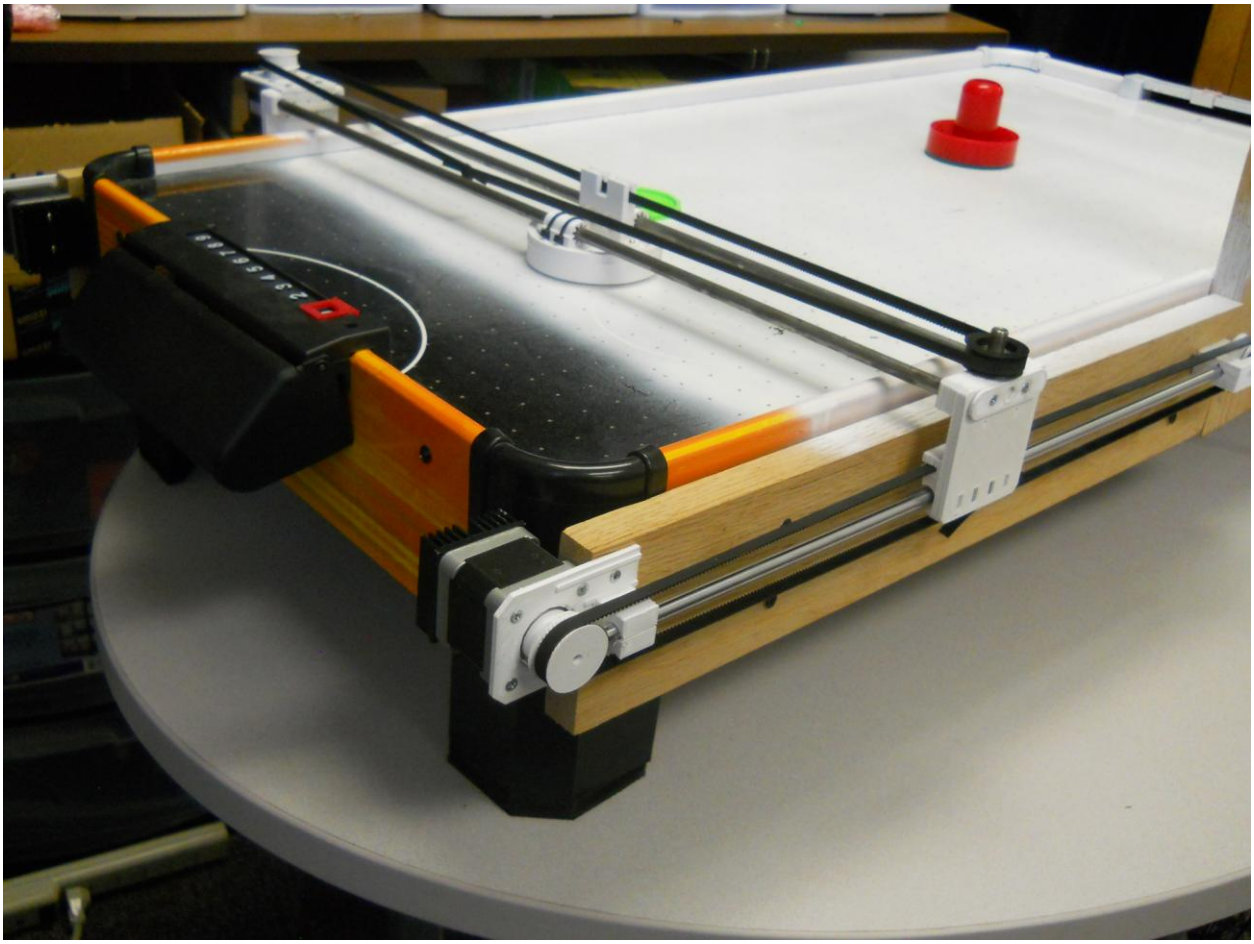

pi@raspberrypi: ~/maestro-linux
File Edit Options Buffers Tools Python Help
#!/usr/bin/python
import serial
import time
import math
from robotArmLib import *
def loadPen(ser):
servo = 1
print "Loading Pen"
print "Enter servo 0 when loaded"
print "Servo 5 - Claw"
print "Servo 4 - Wrist"
while servo != 0:
servo = int(raw_input("Servo number: "))
angle = int(raw_input("Angle: "))
speed = 5
setSpeed(ser, servo, speed)
setAngle(ser, servo, angle)
time.sleep(.1)
def setPos(ser, x, y):
speed = 5
servo0 = 0
servo1 = 1
servo2 = 2
setSpeed(ser, servo0, speed)
setSpeed(ser, servo2, speed)
angle = int((math.atan2(y, x)* 360)/(2 * 3.1416))
mag = int(math.hypot(x, y))
print angle
mag2 = mag/2
print mag2
setAngle(ser, servo0, angle + 40)
setAngle(ser, servo2, 160 - mag)
setAngle(ser, servo1, 50 + mag2)
-UU-:----F1 robotPosLib.py All L25 (Python)
Wrote /home/pi/maestro-linux/robotPosLib.py

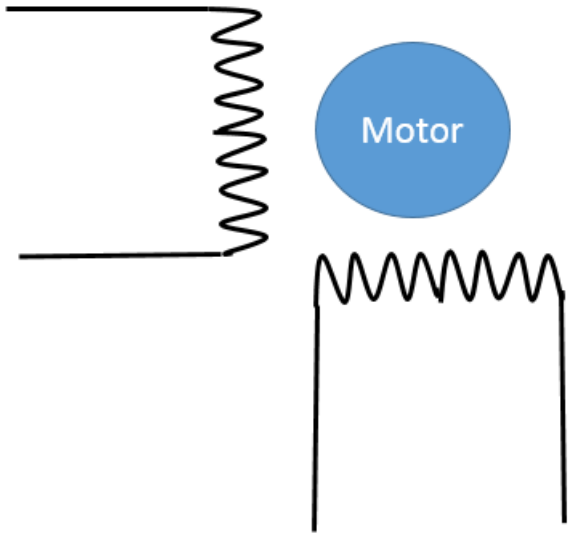

pi@raspberrypi: ~/maestro-linux
File Edit Options Buffers Tools Python Help
import pygame, sys
from robotPosLib import *
black = 0,0,0
white = 0xFF, 0xFF, 0xFF
background_color = 0x12, 0x0E, 0x1C
ser = serial.Serial("/dev/ttyACM0", 9600)
width = 64
height = 32
scale = 8
canvas = pygame.Surface((width, height), pygame.SRCALPHA)
canvas.set_at((0,0), white)
canvas.set_at((width-1,height-1), black)
def animation_frame(screen):
screen.fill(background_color)
view = pygame.transform.scale(canvas, (width*scale, height*scale))
screen.blit(view, (0, 0))
def plot((x,y)):
x = int(x/scale)
y = int(y/scale)
print x, y
setPos(ser, x + 50, y)
if 0 <= x < width and 0 <= y < height:
canvas.set_at((x,y), white)
def dispatch(event):
if event.type == pygame.QUIT:
sys.exit(0)
if event.type == pygame.MOUSEBUTTONDOWN:
plot(event.pos)
if event.type == pygame.MOUSEMOTION and event.buttons != (0,0,0):
plot(event.pos)
pygame.display.init()
screen = pygame.display.set_mode((320, 240))
while 1:
for event in pygame.event.get():
dispatch(event)
animation_frame(screen)
pygame.display.flip()
-UU-:----F1 robotDraw.py All L1 (Python)

Chapter 6: A Robot That Can Play Air Hockey

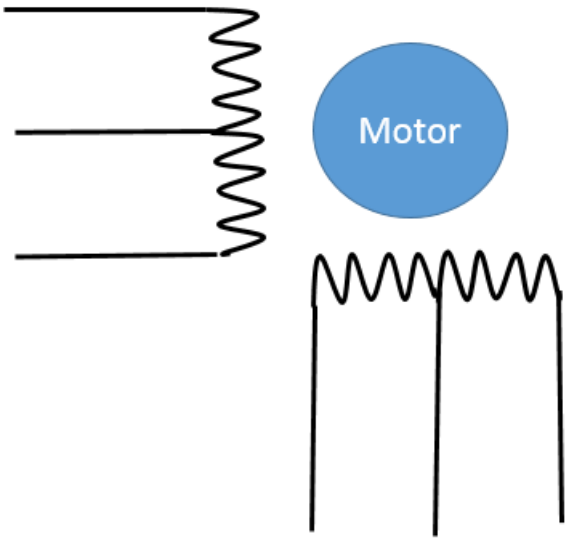


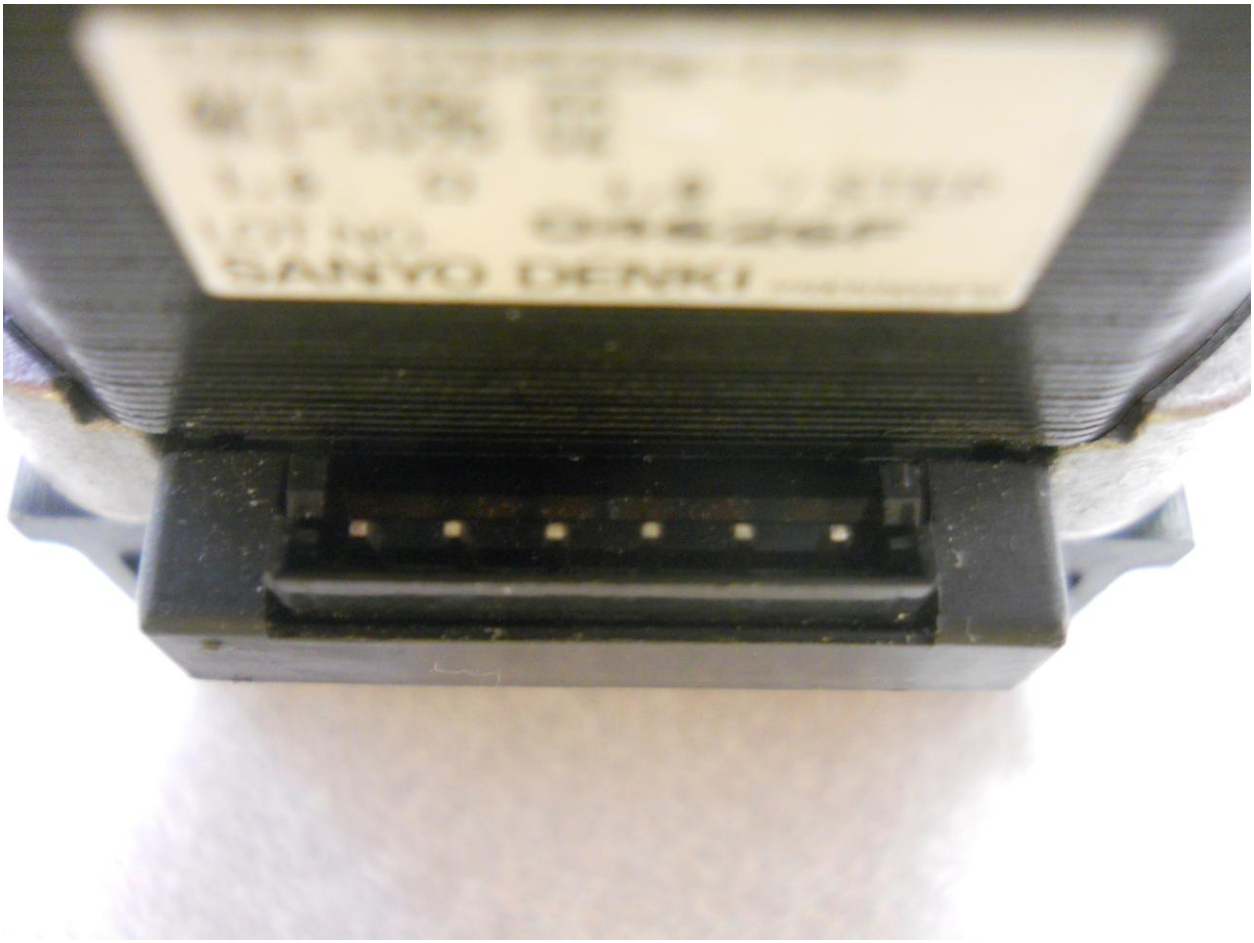

TYPE 103H520-1242
4K1-1096 02
1.6 Ω 1.8 °/STEP
LOT NO. 04626F
SANYO DENKI MADE IN INDONESIA

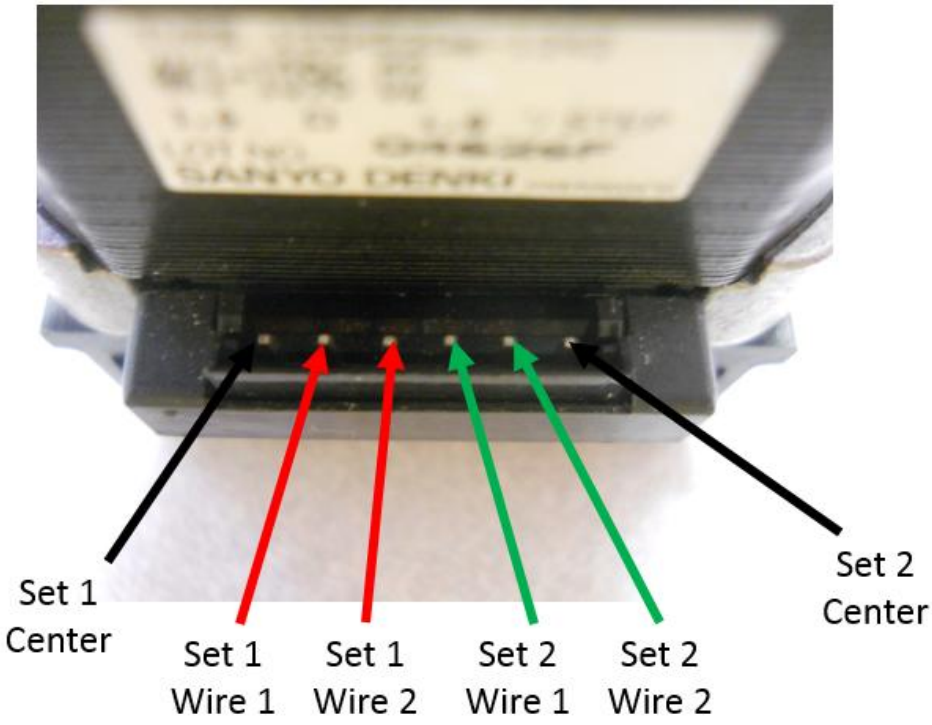
UniPolar Wiring

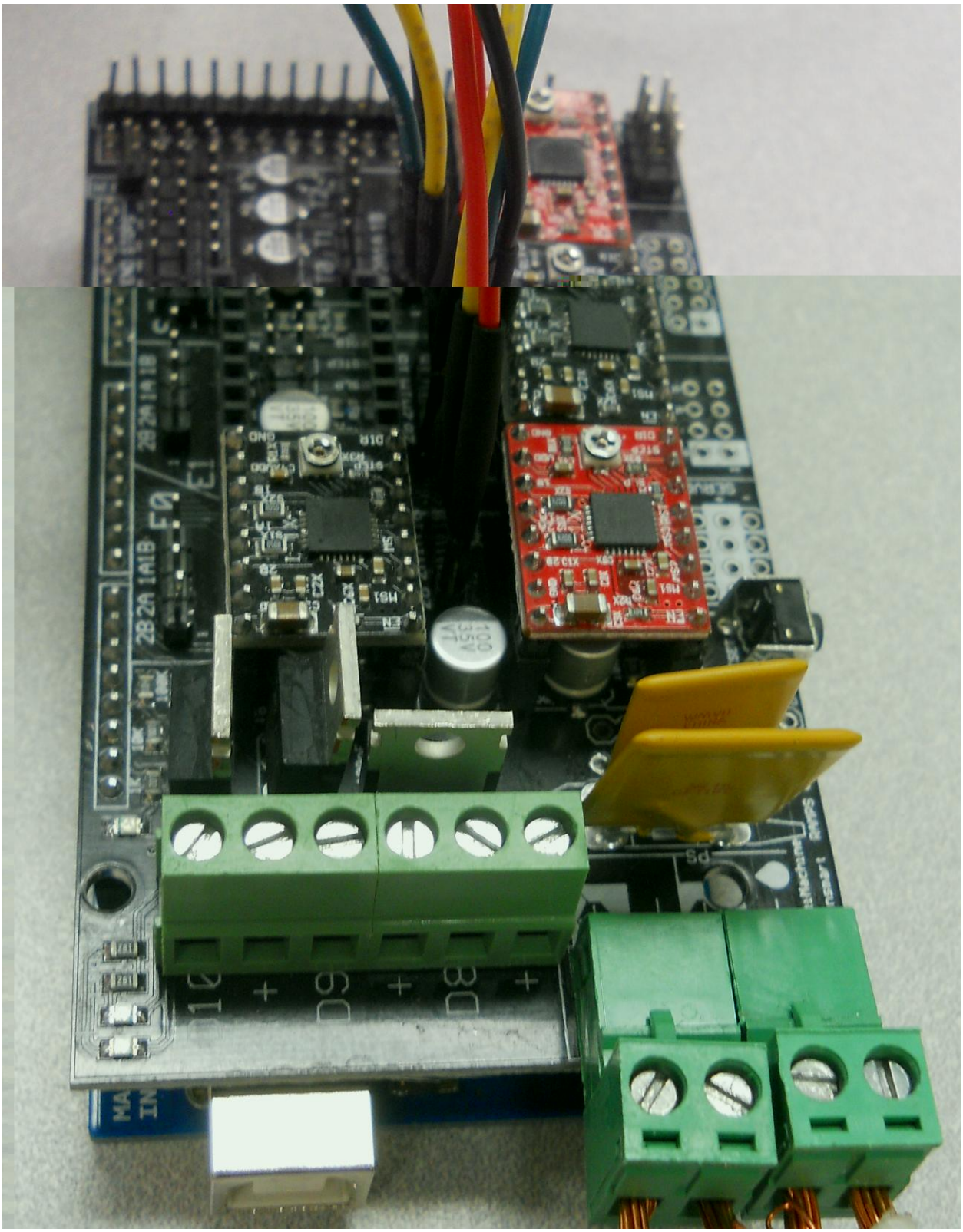


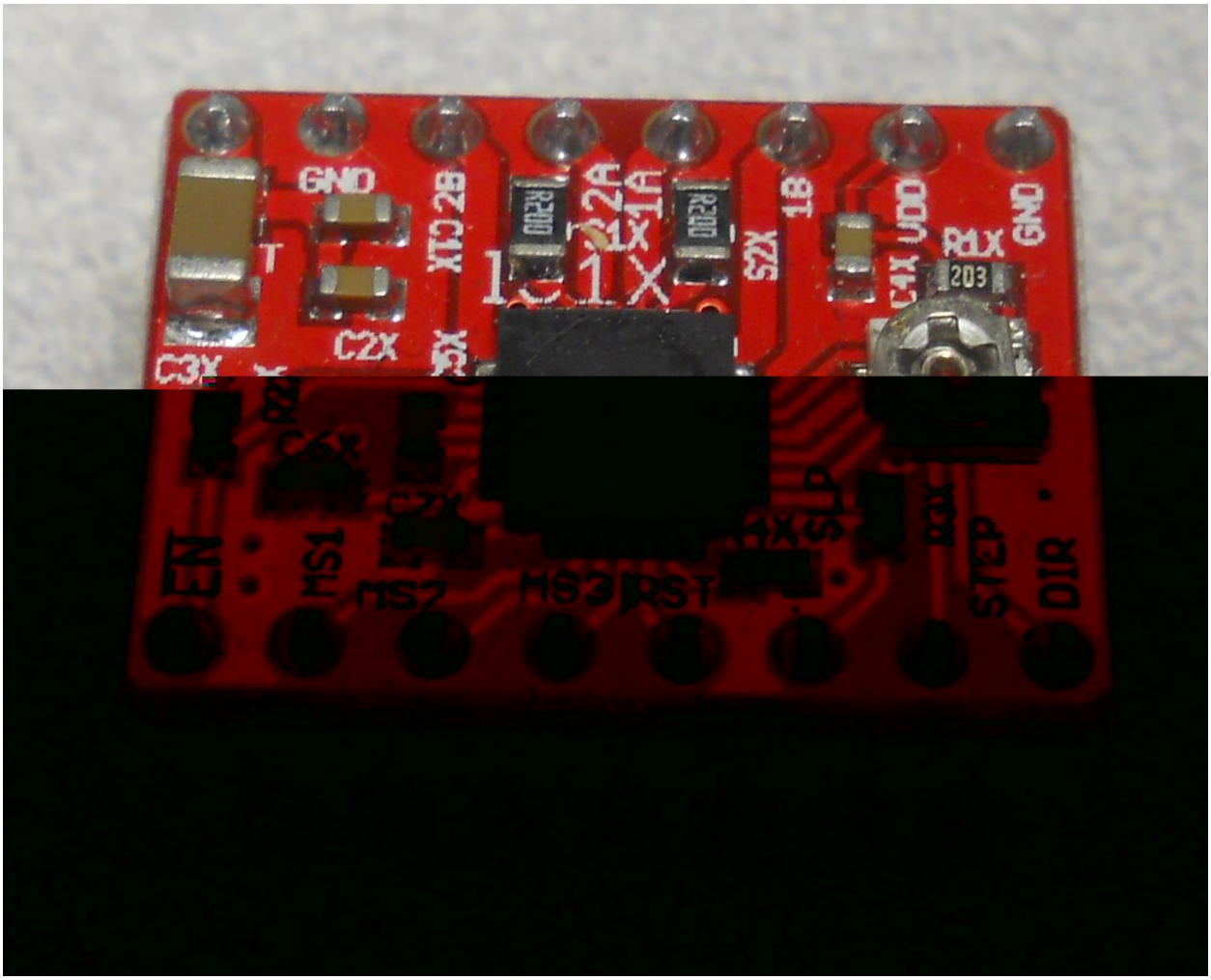
BiPolar Wiring

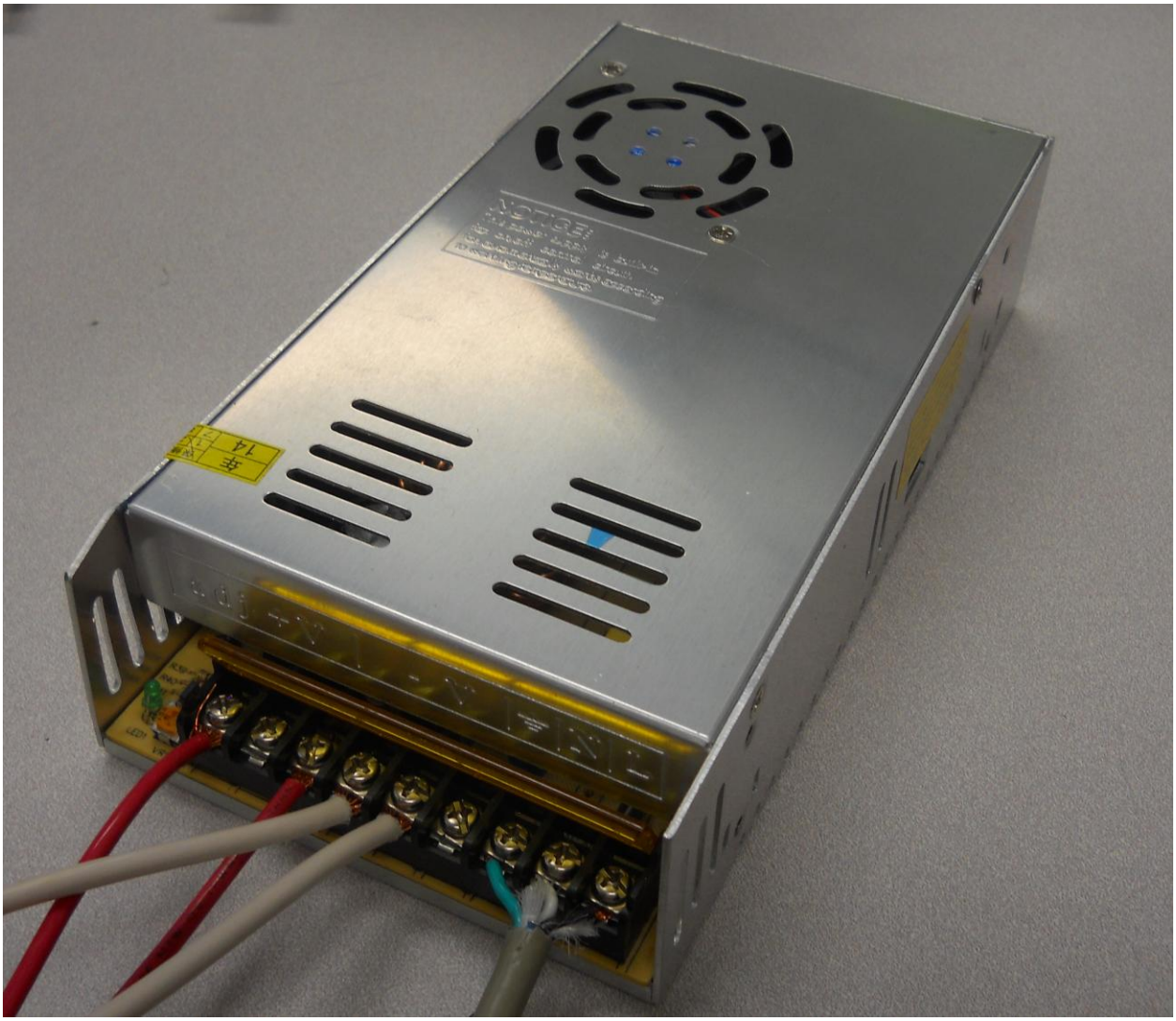


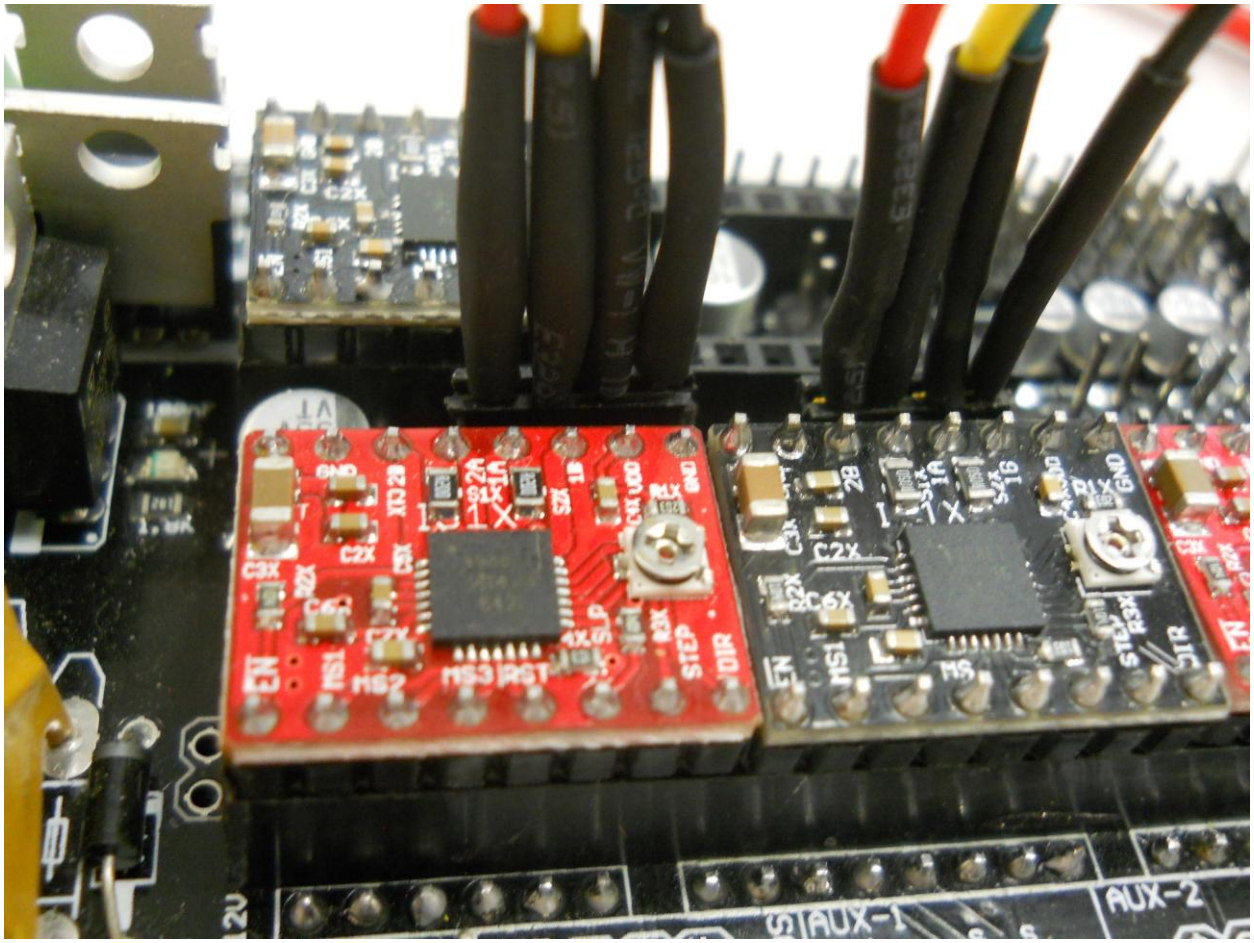

SANYO DENKI

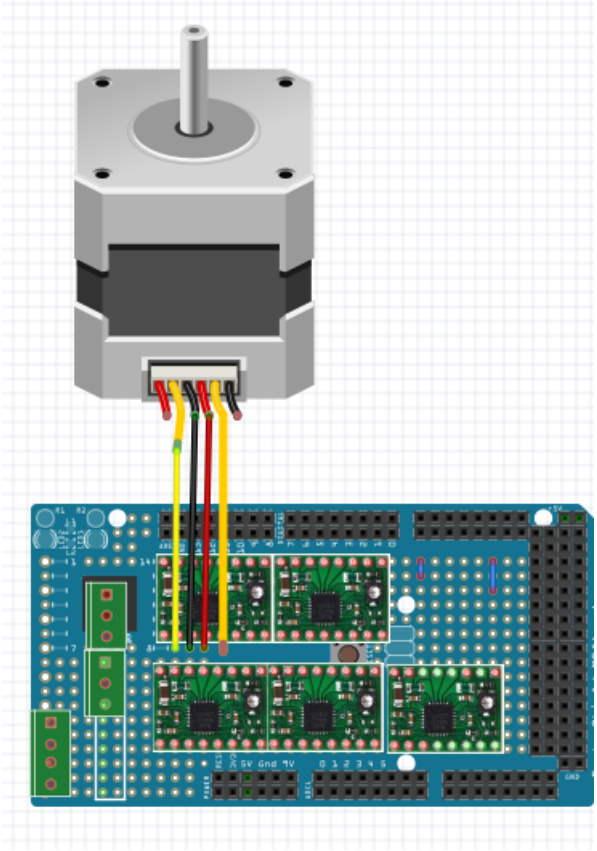

SANYO DENKI
Set 1
Center
Set 1
Wire 1
Set 1
Wire 2
Set 2
Wire 1
Set 2
Wire 2
Set 2
Center

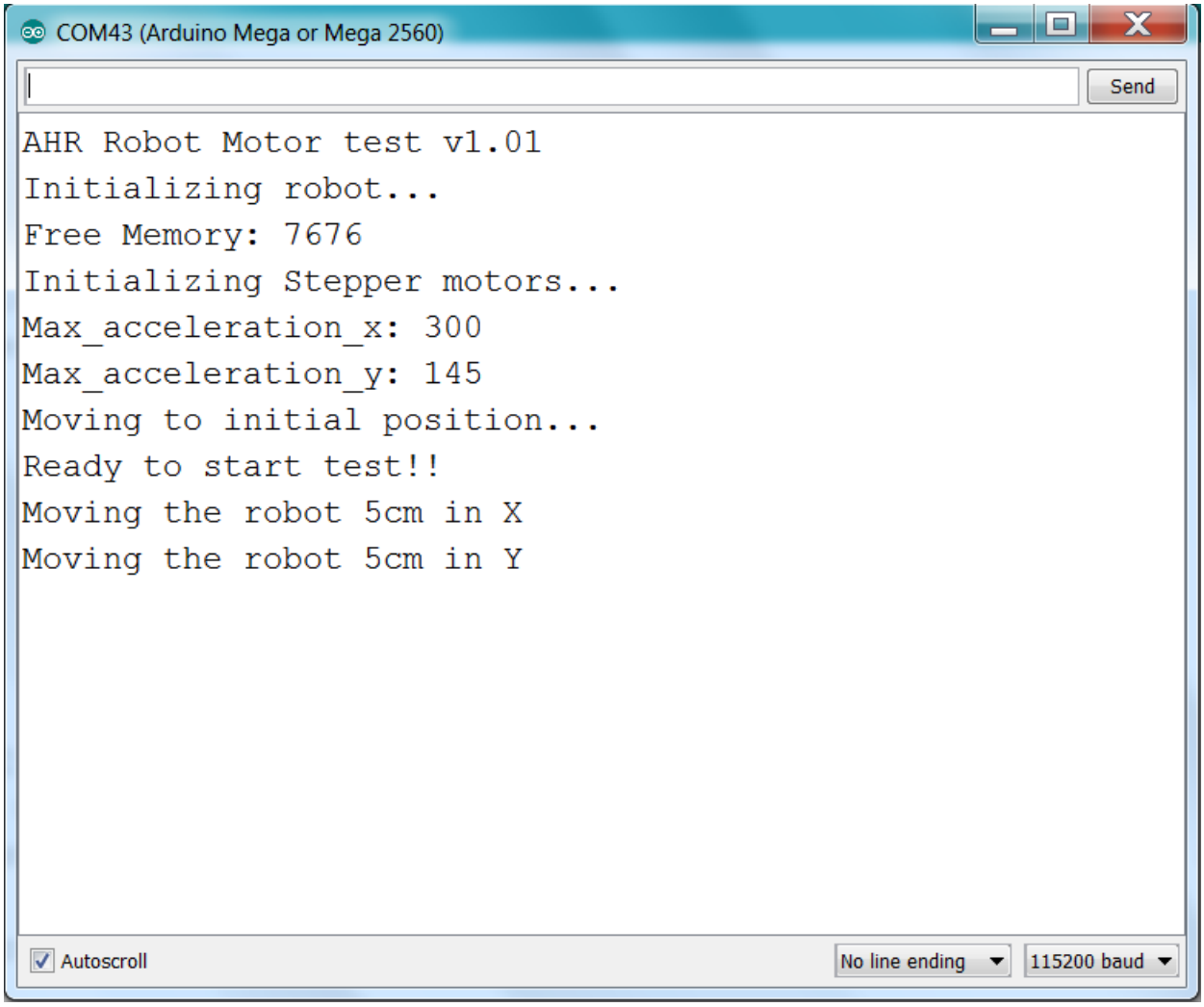

2B2A1A1B
E1
E0
12V
5V
3V


GND
C3X
C2X
2B
2A
1A
1B
VDD
GND
203
EN
MS1
MS2
MS3
RST
STEP
DIR




AUX-1
AUX-2





AHR_Motor_Test | Arduino 1.6.1

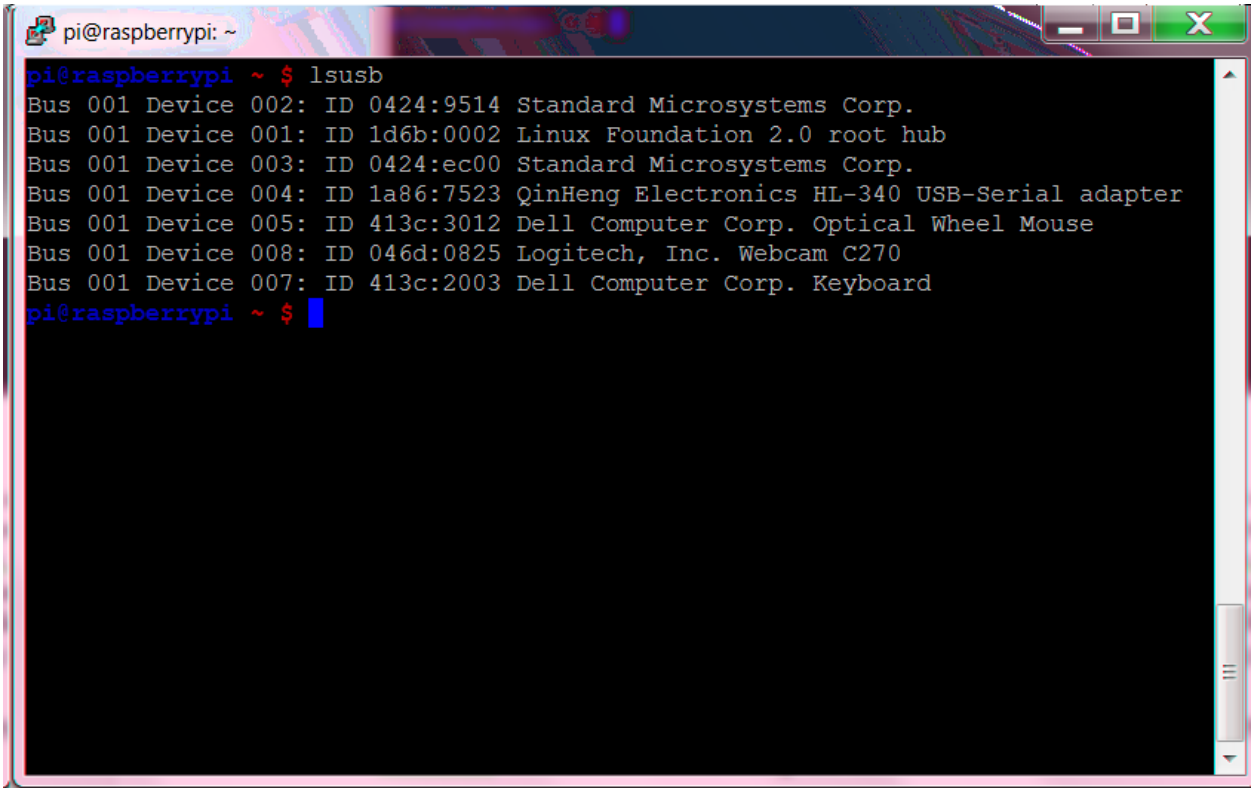
File Edit Sketch Tools Help

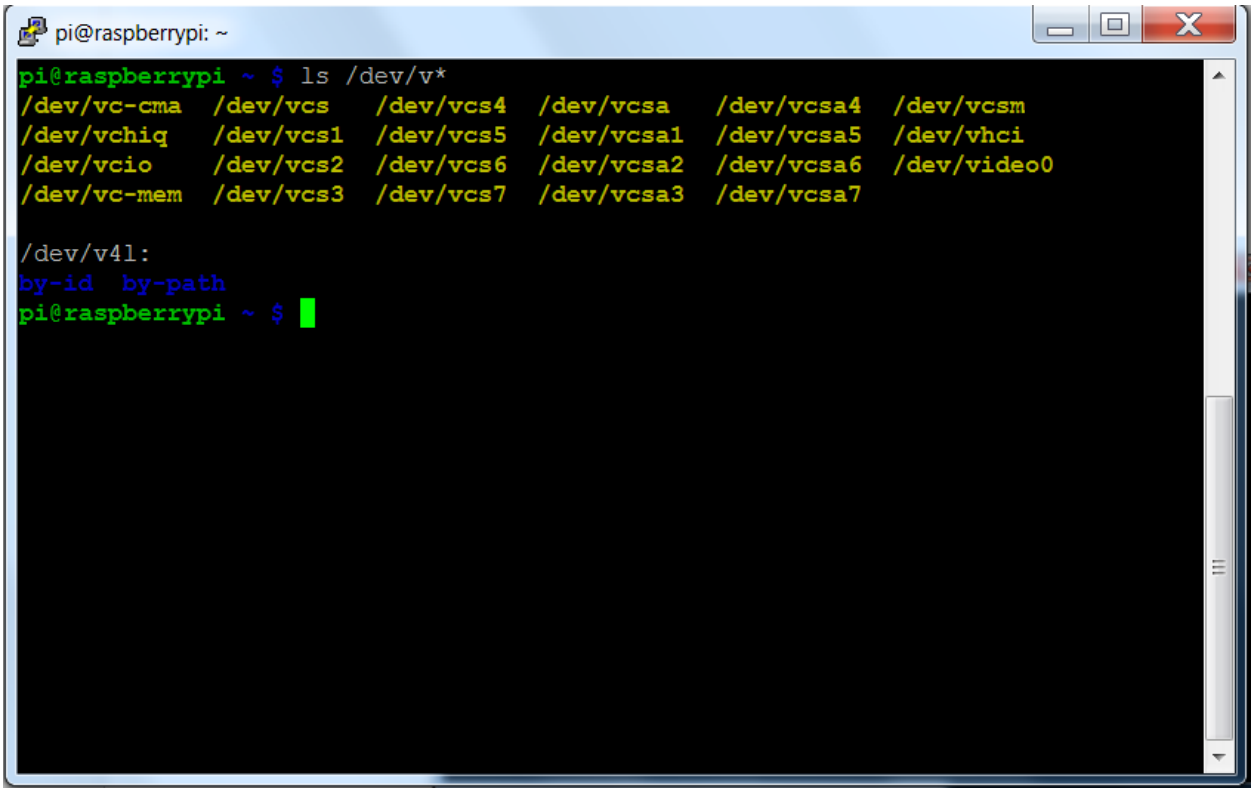
AHR_Motor_Test | Configuration.h | Definitions.h | Steppers

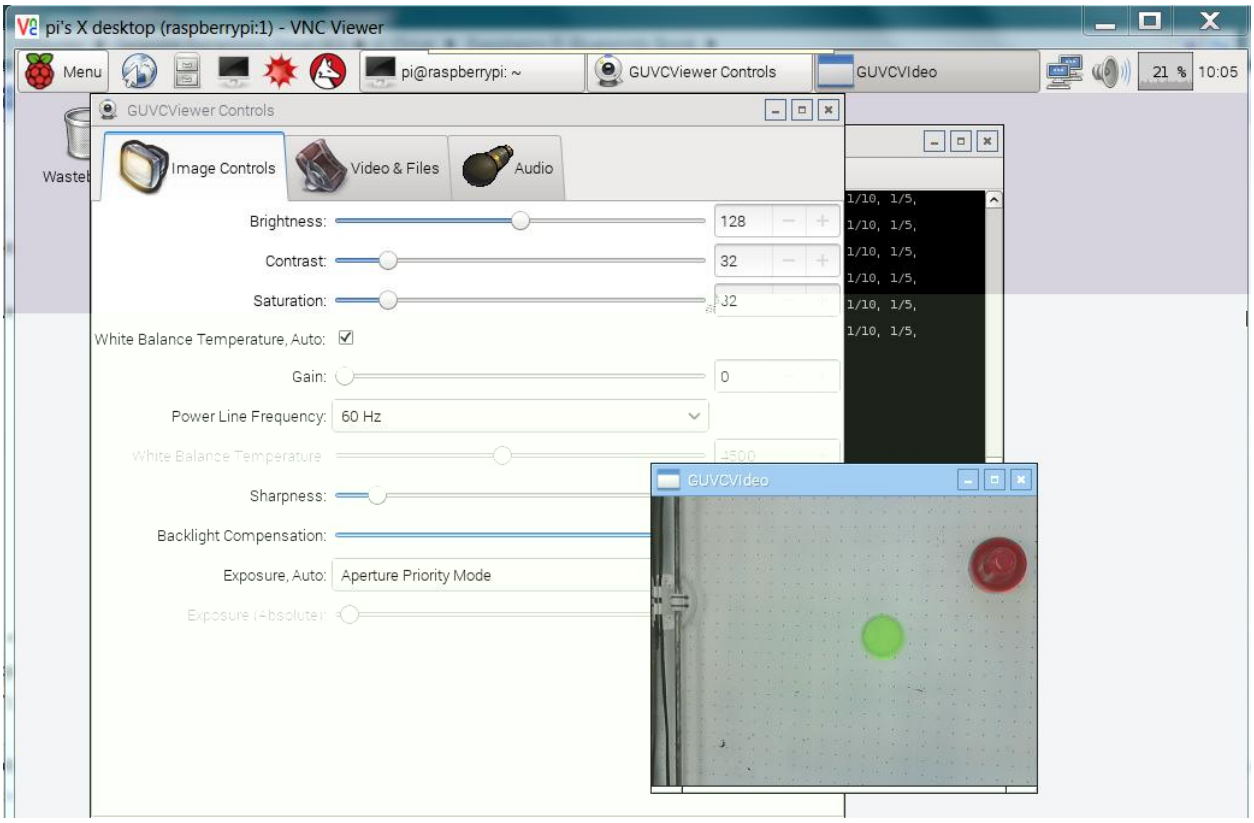
```
//#define MAX_ACCEL_Y 200    //140//220
//#define MAX_SPEED_X 28000     //max 25000 for 12V   // Maximun speed in steps/seg
//#define MAX_SPEED_Y 28000


// This is for the Accel ramp implementation (to smooth the intial acceleration), simplified S-profile
#define ACCEL_RAMP_MIN 2500  // The S profile is generated up to this speed
#define ACCEL_RAMP_MAX 10000

// UNCOMMENT THIS LINES TO INVERT MOTORS
#define INVERT_X_AXIS 1
#define INVERT_Y_AXIS 1  //Y-LEFT
//#define INVERT_Z_AXIS 1  //Y_RIGHT
```

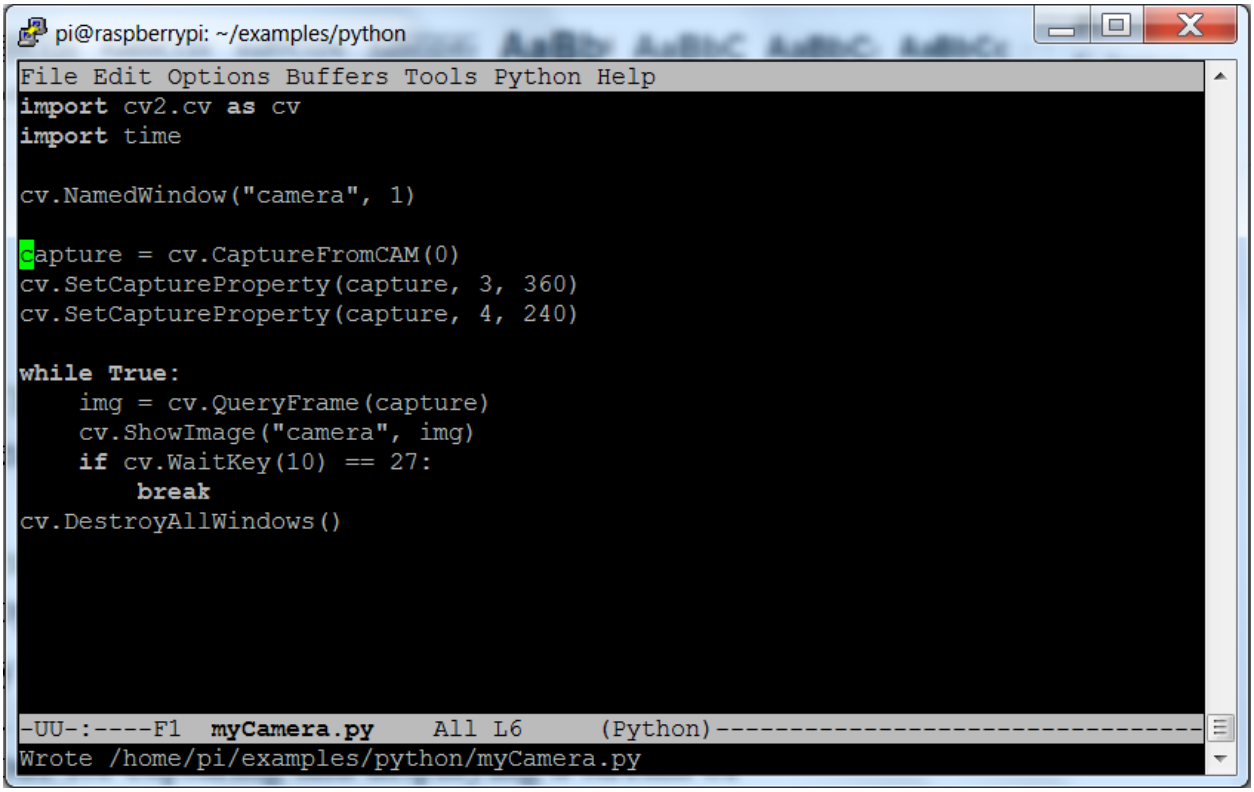
```
#define ACCEL_RAMP_MIN 2500  // The S profile is generated up to this speed
#define ACCEL_RAMP_MAX 10000

// UNCOMMENT THIS LINES TO INVERT MOTORS
#define INVERT_X_AXIS 1
#define INVERT_Y_AXIS 1  //Y-LEFT
//#define INVERT_Z_AXIS 1  //Y_RIGHT

// Geometric calibration.
// This depends on the pulley teeth. For 42 teeth GT2 => 19, for 40 teeth GT2 => 20, for 16 teeth T5 => 20 ,
define X_AXIS_STEPS_PER_UNIT 10
define Y_AXIS_STEPS_PER_UNIT 10

/ Absolute Min and Max robot positions in mm (measured from center of robot pusher)
define ROBOT_MIN_X 100
define ROBOT_MIN_Y 80
define ROBOT_MAX_X 500
define ROBOT_MAX_Y 400
```

```
Absolute Min and Max robot positions in mm (measured from center of robot pusher)
fine ROBOT_MIN_X 100
fine ROBOT_MIN_Y 80
fine ROBOT_MAX_X 500
fine ROBOT_MAX_Y 400

This is the center of the table. All units in milimeters
fine ROBOT_CENTER_X 300   // Center of robot. The table is 600x1000mm, so center is 300,500
fine ROBOT_CENTER_Y 500

Initial robot position in mm
The robot must be at this position at start time
Default: Centered in X and minimun position in Y
fine ROBOT_INITIAL_POSITION_X 300
fine ROBOT_INITIAL_POSITION_Y 45   // Measured from center of the robot pusher to the table border

Robot defense and attack lines
fine ROBOT_DEFENSE_POSITION 95
fine ROBOT_DEFENSE_ATTACK_POSITION 220
```


pi@raspberrypi: ~
pi@raspberrypi ~ $ lsusb
Bus 001 Device 002: ID 0424:9514 Standard Microsystems Corp.
Bus 001 Device 001: ID 1d6b:0002 Linux Foundation 2.0 root hub
Bus 001 Device 003: ID 0424:ec00 Standard Microsystems Corp.
Bus 001 Device 004: ID 1a86:7523 QinHeng Electronics HL-340 USB-Serial adapter
Bus 001 Device 005: ID 413c:3012 Dell Computer Corp. Optical Wheel Mouse
Bus 001 Device 008: ID 046d:0825 Logitech, Inc. Webcam C270
Bus 001 Device 007: ID 413c:2003 Dell Computer Corp. Keyboard
pi@raspberrypi ~ $

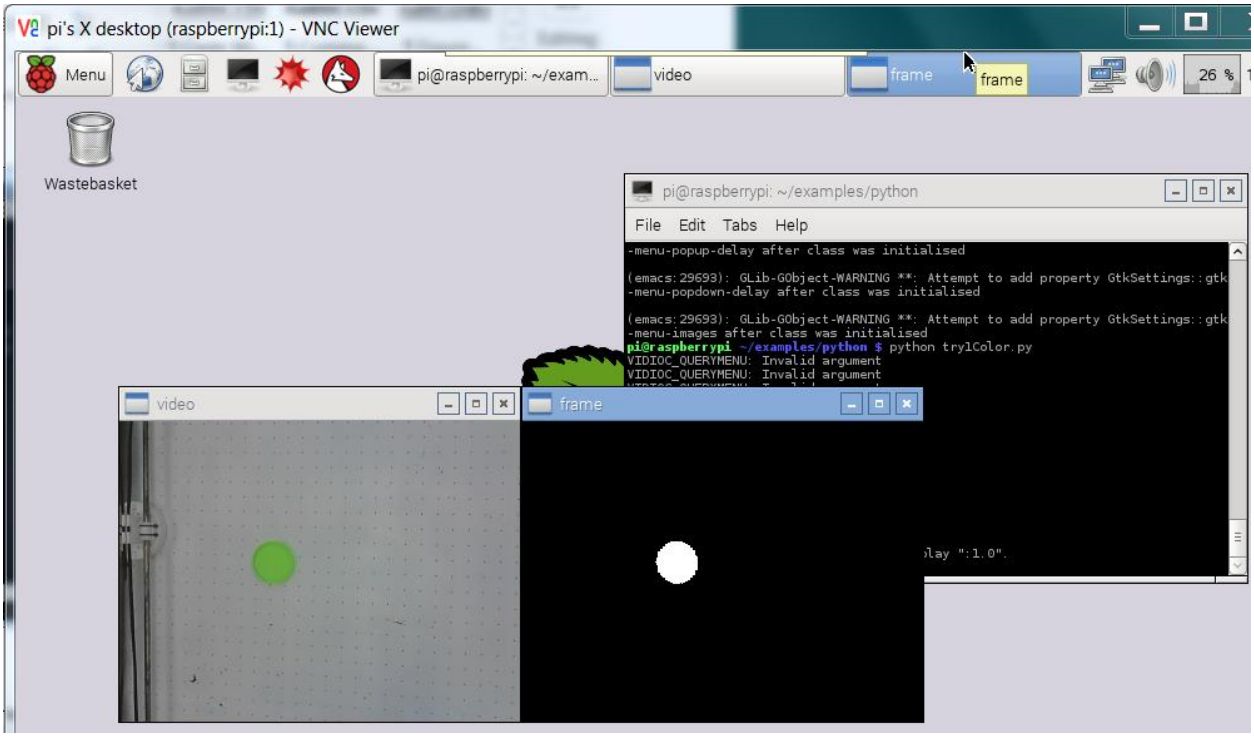

pi@raspberrypi: ~
pi@raspberrypi ~ $ ls /dev/v*
/dev/vc-cma /dev/vcs /dev/vcs4 /dev/vcsa /dev/vcsa4 /dev/vcsm
/dev/vchiq /dev/vcs1 /dev/vcs5 /dev/vcsa1 /dev/vcsa5 /dev/vhci
/dev/vcio /dev/vcs2 /dev/vcs6 /dev/vcsa2 /dev/vcsa6 /dev/video0
/dev/vc-mem /dev/vcs3 /dev/vcs7 /dev/vcsa3 /dev/vcsa7
/dev/v4l:
by-id by-path
pi@raspberrypi ~ $


pi's X desktop (raspberrypi:1) - VNC Viewer
Menu
pi@raspberrypi: ~
GUVCViewer Controls
GUVCVIdeo
21 %
10:05
GUVCViewer Controls
Image Controls
Video & Files
Audio
Brightness:
128
Contrast:
32
Saturation:
White Balance Temperature, Auto:
Gain:
0
Power Line Frequency:
60 Hz
Sharpness:
Backlight Compensation:
Exposure, Auto:
Aperture Priority Mode
GUVCVideo


pi@raspberrypi: ~/examples/python
File Edit Options Buffers Tools Python Help
import cv2.cv as cv
import time
cv.NamedWindow("camera", 1)
capture = cv.CaptureFromCAM(0)
cv.SetCaptureProperty(capture, 3, 360)
cv.SetCaptureProperty(capture, 4, 240)
while True:
img = cv.QueryFrame(capture)
cv.ShowImage("camera", img)
if cv.WaitKey(10) == 27:
break
cv.DestroyAllWindows()
-UU-:----F1 myCamera.py All L6 (Python)
Wrote /home/pi/examples/python/myCamera.py

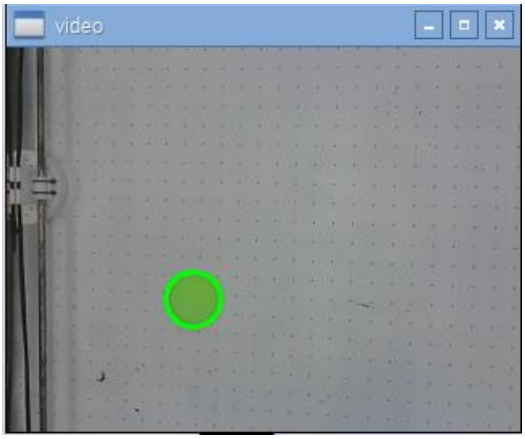
pi@raspberrypi: ~/examples/python

```
File Edit Options Buffers Tools Python Help
import numpy as np
import cv2

cap = cv2.VideoCapture(0)
cap.set(3,320)
cap.set(4,240)
low_range = np.array([10, 120, 100])
high_range = np.array([70, 255, 255])

while(cap.isOpened()):
    ret, frame = cap.read()
    hue_image = cv2.cvtColor(frame, cv2.COLOR_BGR2HSV)
    threshold_img = cv2.inRange(hue_image, low_range, high_range)
    cv2.imshow('video',frame)
    cv2.imshow('frame',threshold_img)
    if cv2.waitKey(1) & 0xFF == ord('q'):
        break

cap.release()
cv2.destroyAllWindows()



-UU-:----F1  try1.py        All L18     (Python)----------------------------------
Wrote /home/pi/examples/python/try1.py
```


pi's X desktop (raspberrypi:1) - VNC Viewer
Menu
pi@raspberrypi: ~/exam...
video
frame
frame
26 %
Wastebasket
pi@raspberrypi: ~/examples/python
File Edit Tabs Help
-menu-popup-delay after class was initialised
(emacs:29693): GLib-GObject-WARNING **: Attempt to add property GtkSettings::gtk
-menu-popdown-delay after class was initialised
(emacs:29693): GLib-GObject-WARNING **: Attempt to add property GtkSettings::gtk
-menu-images after class was initialised
pi@raspberrypi ~/examples/python $ python trylColor.py
VIDIOC_QUERYMENU: Invalid argument
VIDIOC_QUERYMENU: Invalid argument
video
frame

pi@raspberrypi: ~/examples/python

```
File Edit Options Buffers Tools Python Help
import numpy as np
import cv2

cap = cv2.VideoCapture(0)
cap.set(3,320)
cap.set(4,240)
low_range = np.array([10, 120, 100])
high_range = np.array([70, 255, 255])

while(cap.isOpened()):
    ret, frame = cap.read()
    hue_image = cv2.cvtColor(frame, cv2.COLOR_BGR2HSV)
    threshold_img = cv2.inRange(hue_image, low_range, high_range)
    contour, hierarchy = cv2.findContours(threshold_img, cv2.RETR_TREE, cv2.CHA\
IN_APPROX_SIMPLE)
    center = contour[0]
    moment = cv2.moments(center)
    (x,y),radius = cv2.minEnclosingCircle(center)
    center = (int(x),int(y))
    radius = int(radius)
    img = cv2.circle(frame,center,radius,(0,255,0),2)
    cv2.imshow('video',frame)
    if cv2.waitKey(1) & 0xFF == ord('q'):
        break


cap.release()
cv2.destroyAllWindows()


-UU-:**--F1  try1.py        All L22     (Python)----------------------------------
```

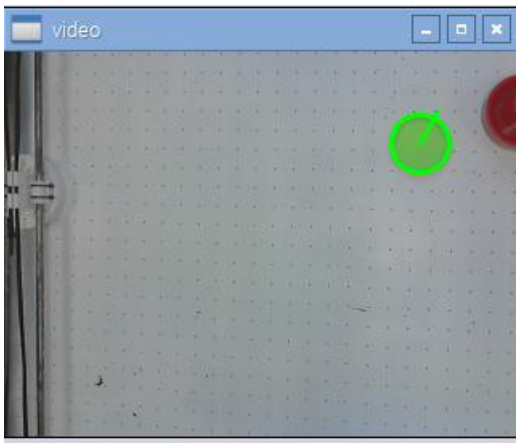


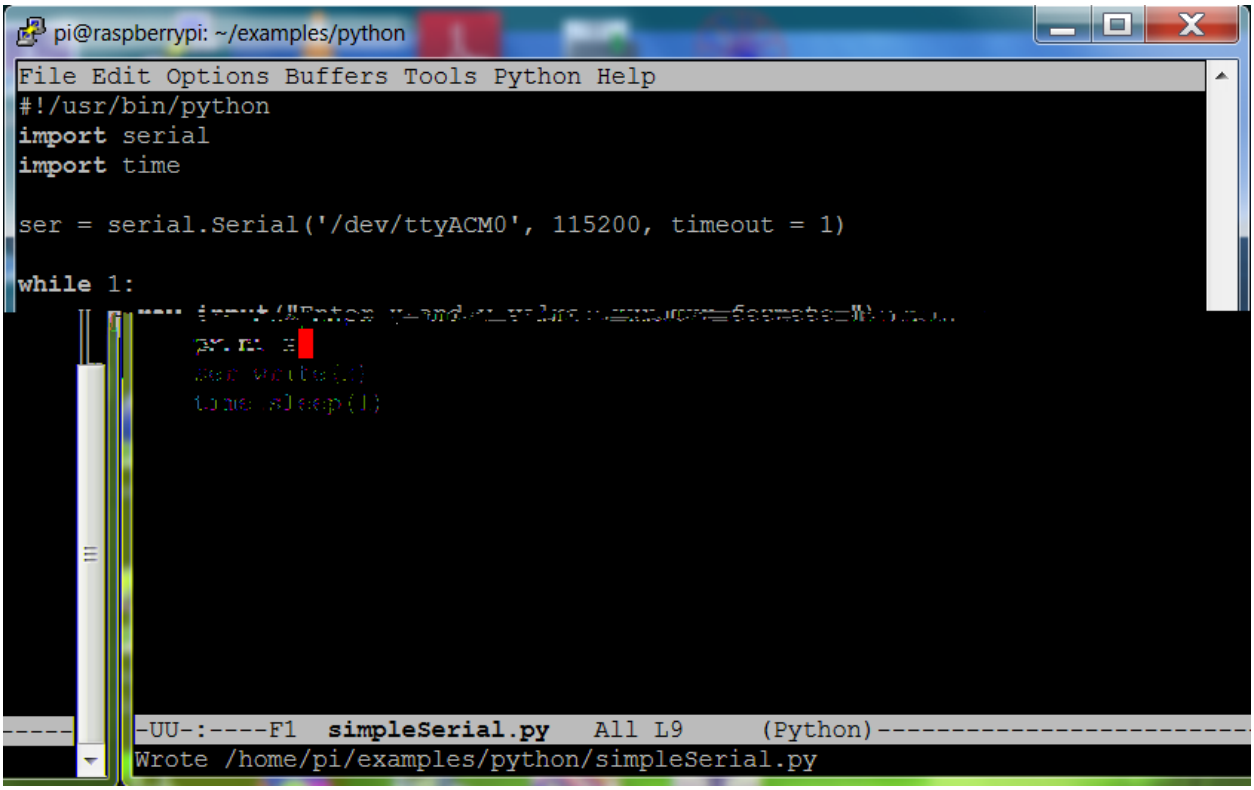
pi@raspberrypi: ~/examples/python

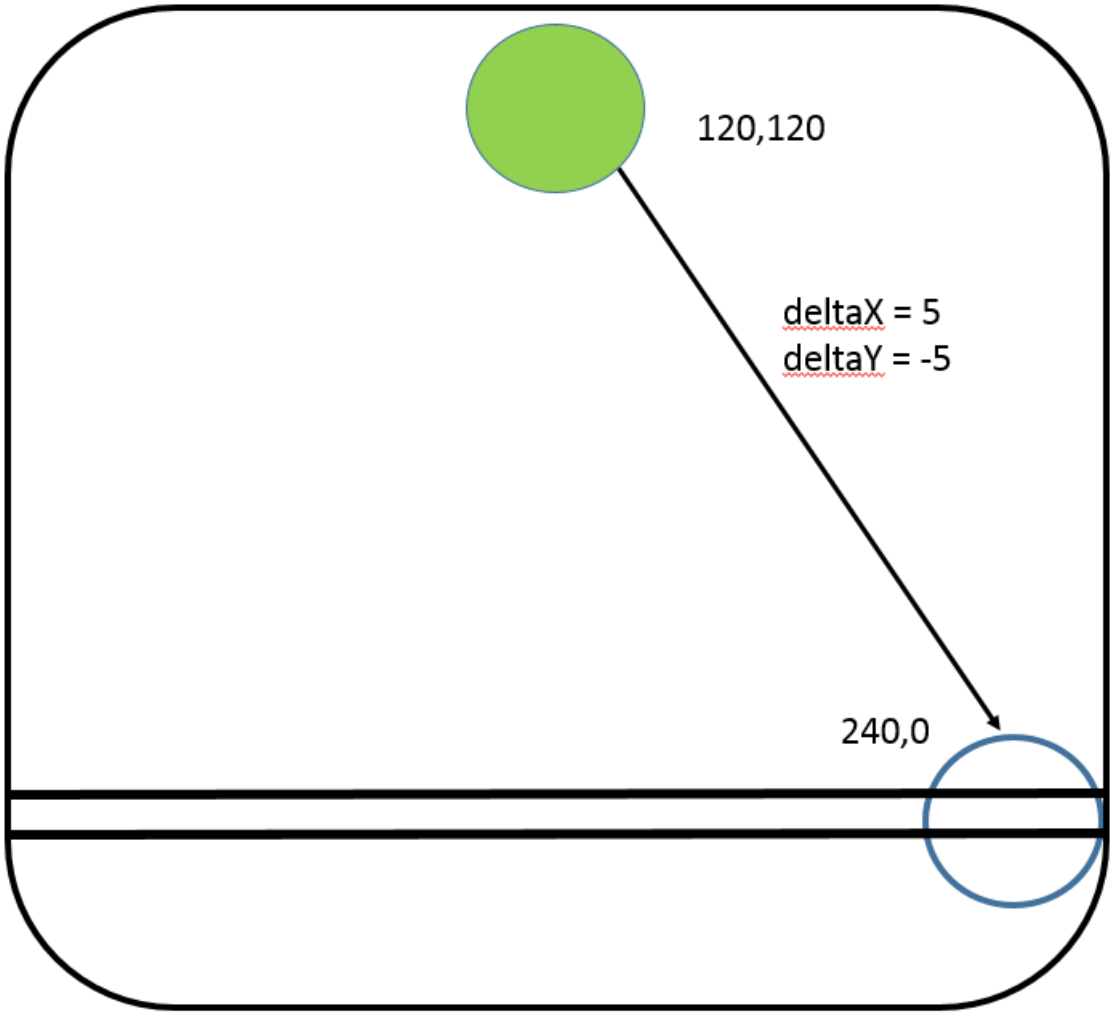
File Edit Options Buffers Tools Python Help

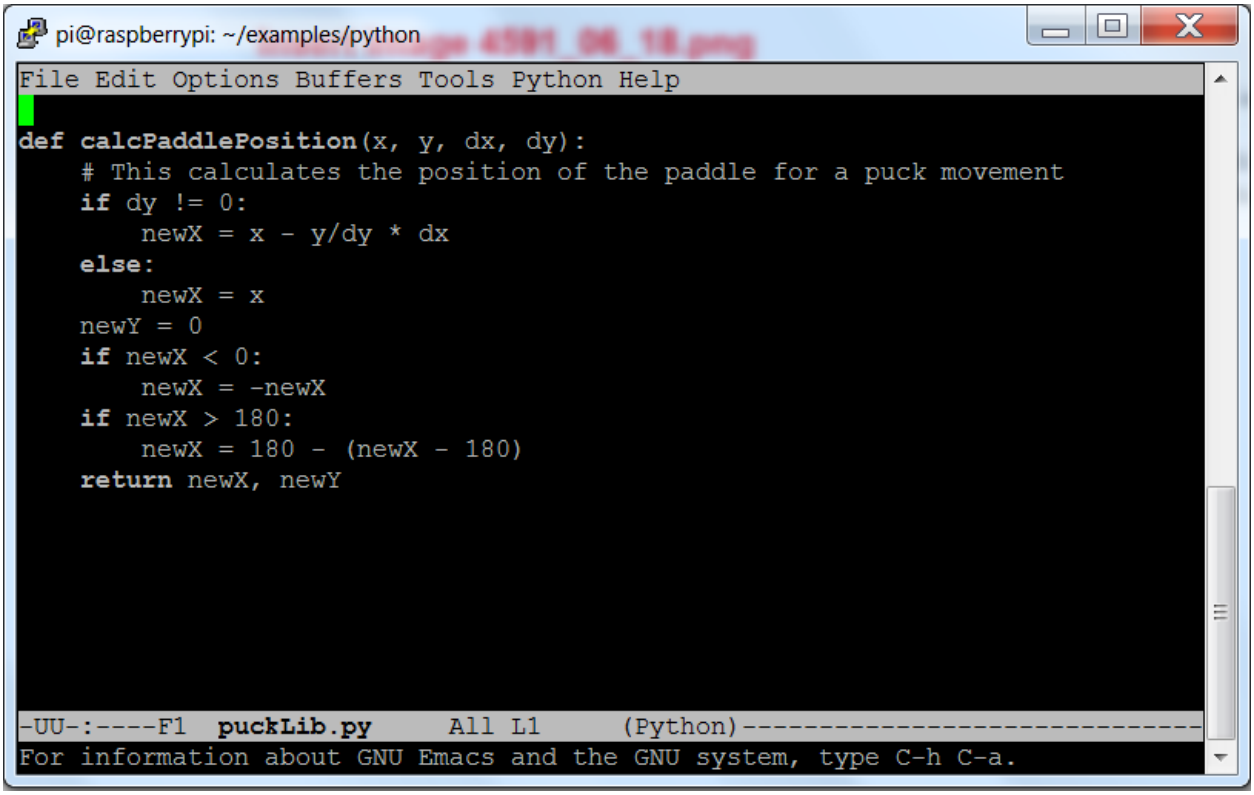
```
import cv2
import numpy as np

cap = cv2.VideoCapture(0)
cap.set(3, 360)
cap.set(4, 240)
low_range = np.array([10, 120, 100])
high_range = np.array([70, 255, 255])
lastX = 0
lastY = 0
deltaX = 0
deltaY = 0

while (cap.isOpened()):
    ret, frame = cap.read()
    hue_image = cv2.cvtColor(frame, cv2.COLOR_BGR2HSV)
    threshold_img = cv2.inRange(hue_image, low_range, high_range)
    contour, hierarchy = cv2.findContours(threshold_img, cv2.RETR_TREE, cv2.CHAIN_APPROX_SIMPLE)
    if contour:
        center = contour[0]
        moment = cv2.moments(center)
        (x,y),radius = cv2.minEnclosingCircle(center)
        center = (int(x), int(y))
        deltaX = int(x) - lastX
        deltaY = int(y) - lastY
        lastX = int(x)
        lastY = int(y)
        radius = int(radius)
        img = cv2.circle(frame, center, radius, (0, 255, 0), 2)
        img = cv2.line(frame, (lastX,lastY), (lastX + deltaX, lastY + deltaY), (0, 255, 0), 2)
    cv2.imshow('video', frame)
    if cv2.waitKey(10) == 27:
        break

cap.release
cv2.destroyAllWindows()
```

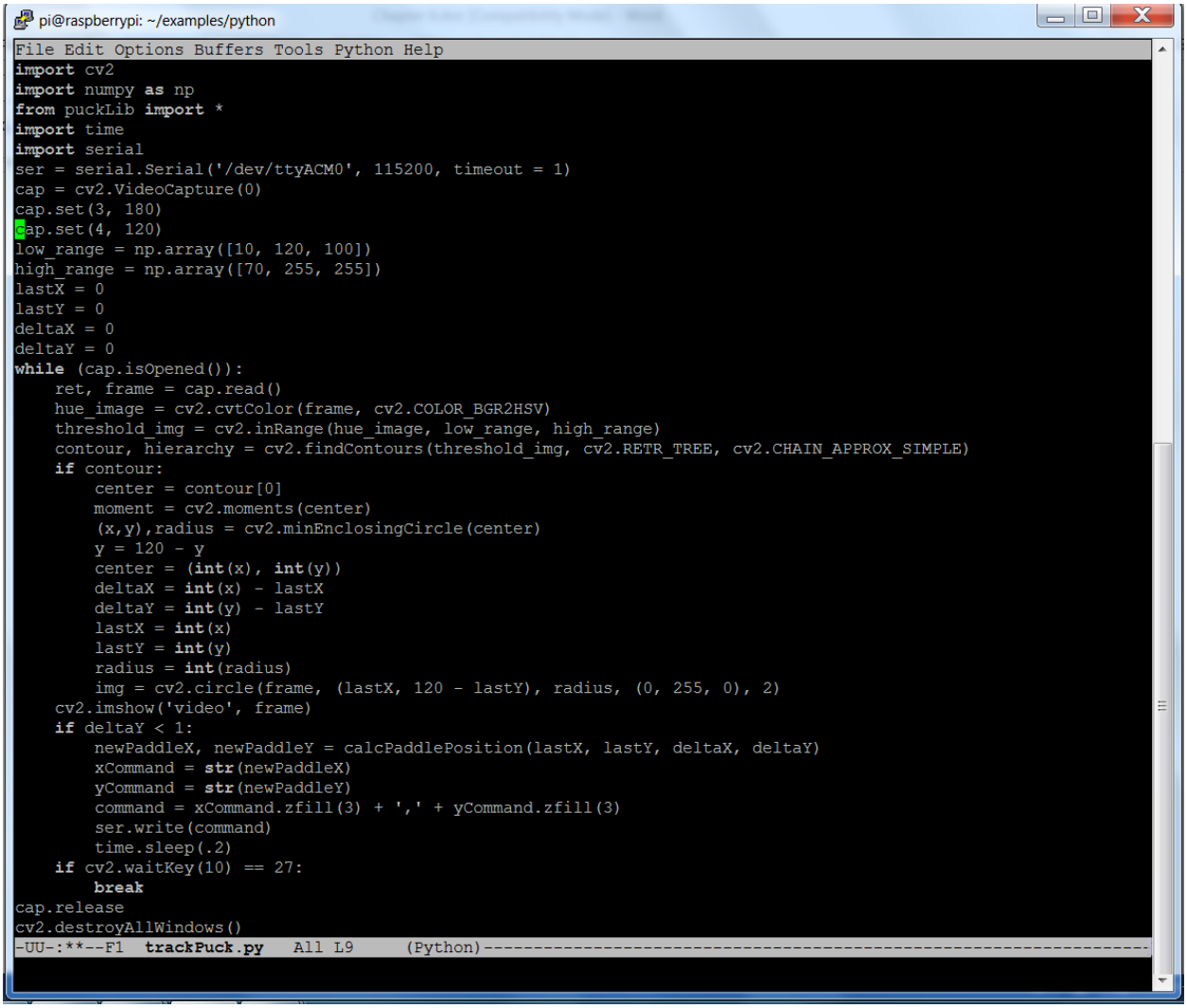
-UU-:**--F1 **trackPuck.py** All L32 (Python)----------



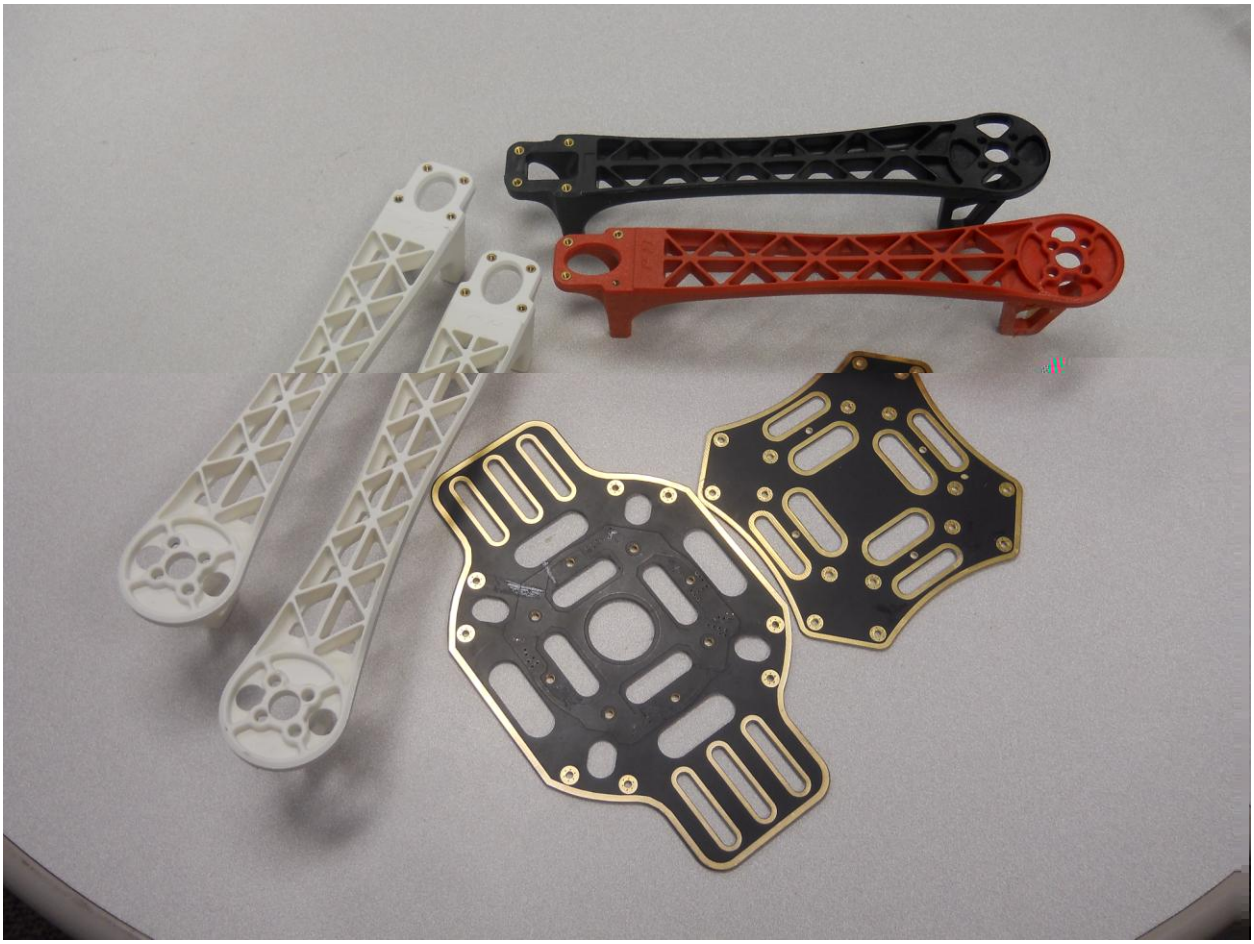

pi@raspberrypi: ~/examples/python
File Edit Options Buffers Tools Python Help
#!/usr/bin/python
import serial
import time
ser = serial.Serial('/dev/ttyACM0', 115200, timeout = 1)
while 1:
-UU-:----F1 simpleSerial.py All L9 (Python)
Wrote /home/pi/examples/python/simpleSerial.py

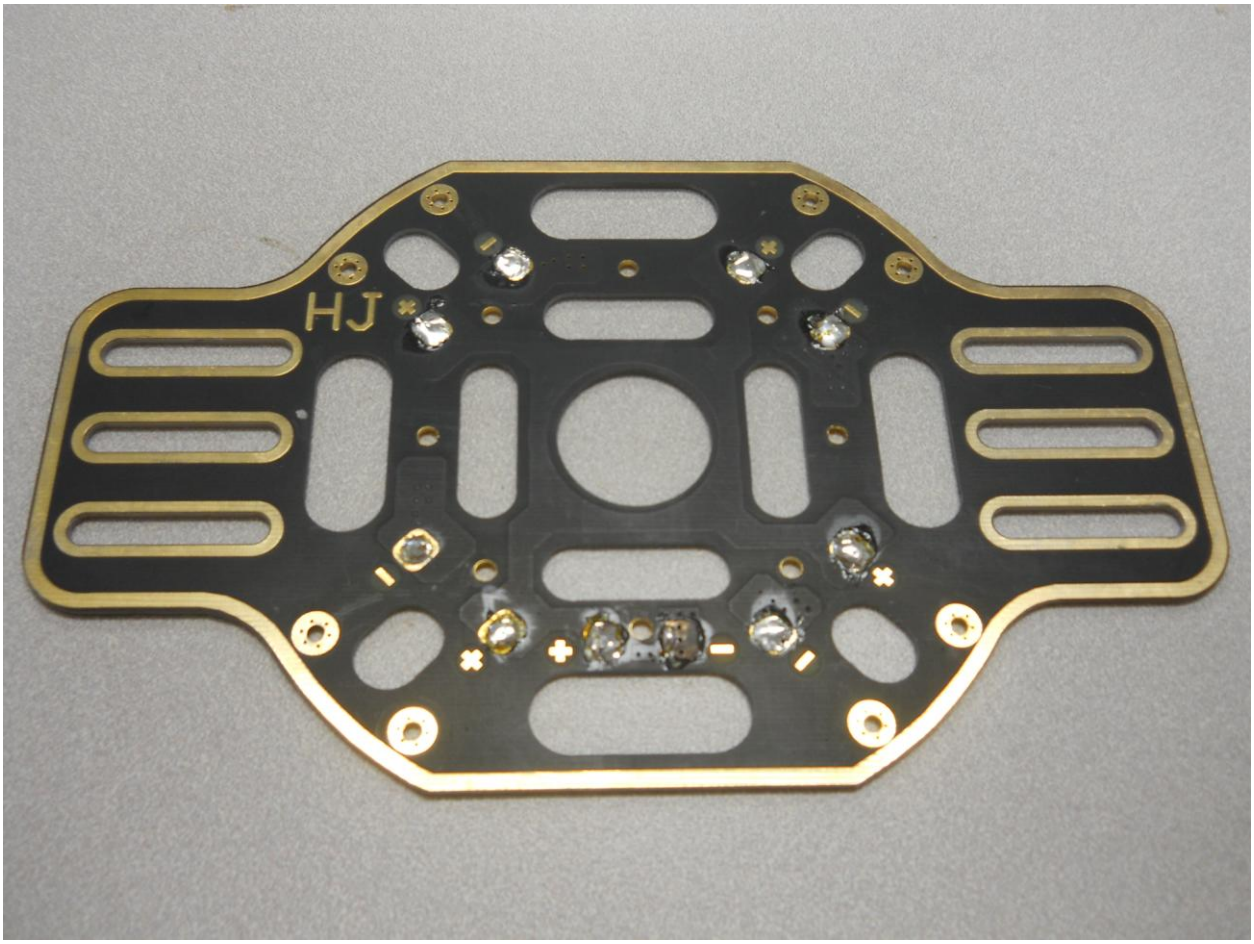

120,120
deltaX = 5
deltaY = -5
240,0

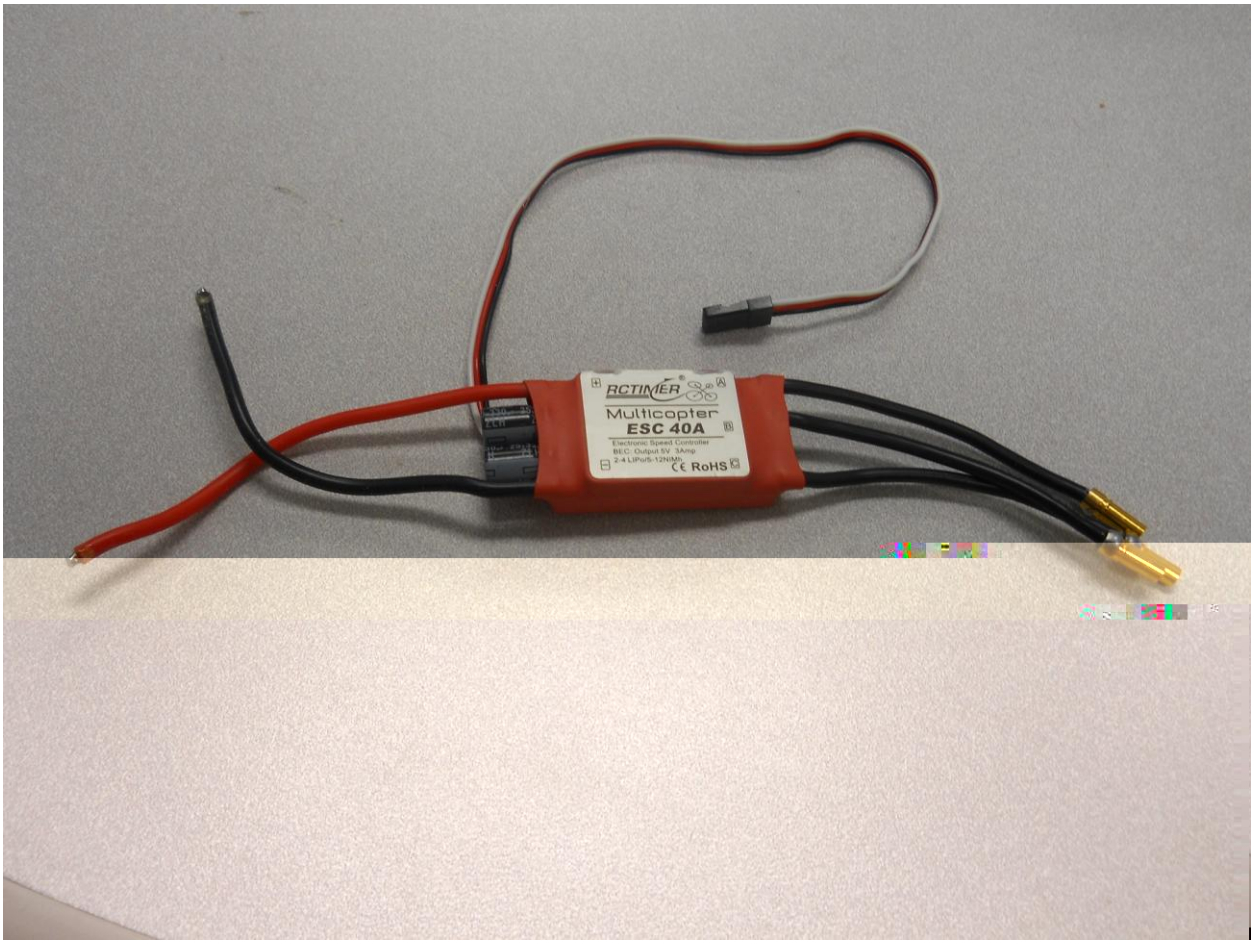

pi@raspberrypi: ~/examples/python
File Edit Options Buffers Tools Python Help
def calcPaddlePosition(x, y, dx, dy):
# This calculates the position of the paddle for a puck movement
if dy != 0:
newX = x - y/dy * dx
else:
newX = x
newY = 0
if newX < 0:
newX = -newX
if newX > 180:
newX = 180 - (newX - 180)
return newX, newY
-UU-:----F1 puckLib.py All L1 (Python)
For information about GNU Emacs and the GNU system, type C-h C-a.

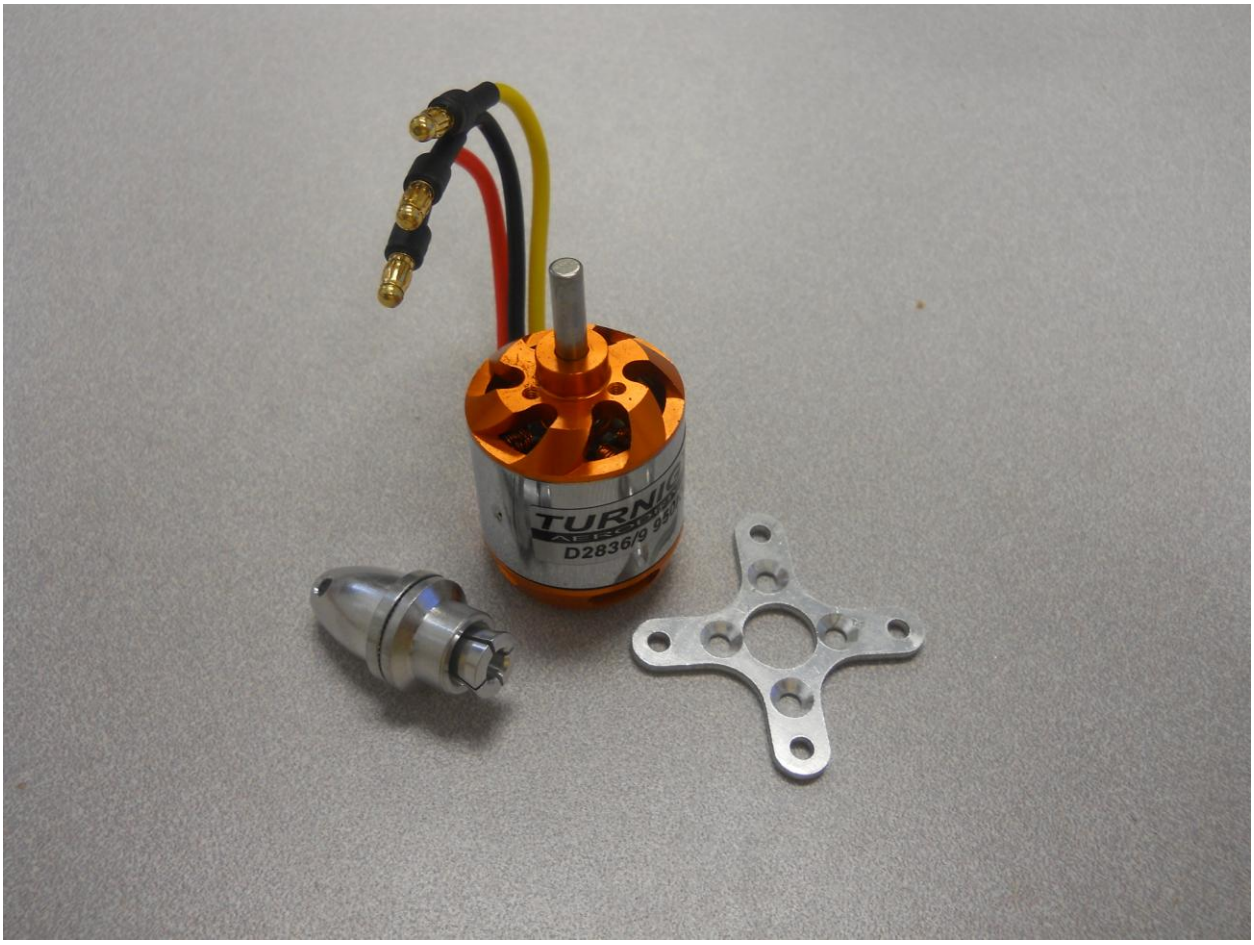

pi@raspberrypi: ~/examples/python
File Edit Options Buffers Tools Python Help
import cv2
import numpy as np
from puckLib import *
import time
import serial
ser = serial.Serial('/dev/ttyACM0', 115200, timeout = 1)
cap = cv2.VideoCapture(0)
cap.set(3, 180)
cap.set(4, 120)
low_range = np.array([10, 120, 100])
high_range = np.array([70, 255, 255])
lastX = 0
lastY = 0
deltaX = 0
deltaY = 0
while (cap.isOpened()):
ret, frame = cap.read()
hue_image = cv2.cvtColor(frame, cv2.COLOR_BGR2HSV)
threshold_img = cv2.inRange(hue_image, low_range, high_range)
contour, hierarchy = cv2.findContours(threshold_img, cv2.RETR_TREE, cv2.CHAIN_APPROX_SIMPLE)
if contour:
center = contour[0]
moment = cv2.moments(center)
(x,y),radius = cv2.minEnclosingCircle(center)
y = 120 - y
center = (int(x), int(y))
deltaX = int(x) - lastX
deltaY = int(y) - lastY
lastX = int(x)
lastY = int(y)
radius = int(radius)
img = cv2.circle(frame, (lastX, 120 - lastY), radius, (0, 255, 0), 2)
cv2.imshow('video', frame)
if deltaY < 1:
newPaddleX, newPaddleY = calcPaddlePosition(lastX, lastY, deltaX, deltaY)
xCommand = str(newPaddleX)
yCommand = str(newPaddleY)
command = xCommand.zfill(3) + ',' + yCommand.zfill(3)
ser.write(command)
time.sleep(.2)
if cv2.waitKey(10) == 27:
break
cap.release
cv2.destroyAllWindows()
-UU-:**--F1 trackPuck.py All L9 (Python)

Chapter 7: A Robot That Can Fly



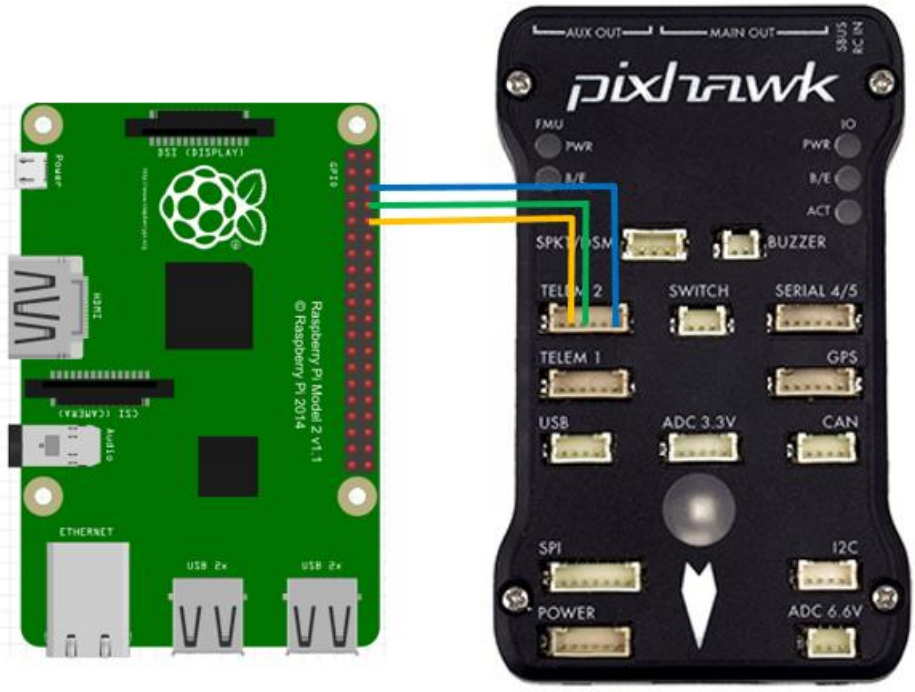

HJ

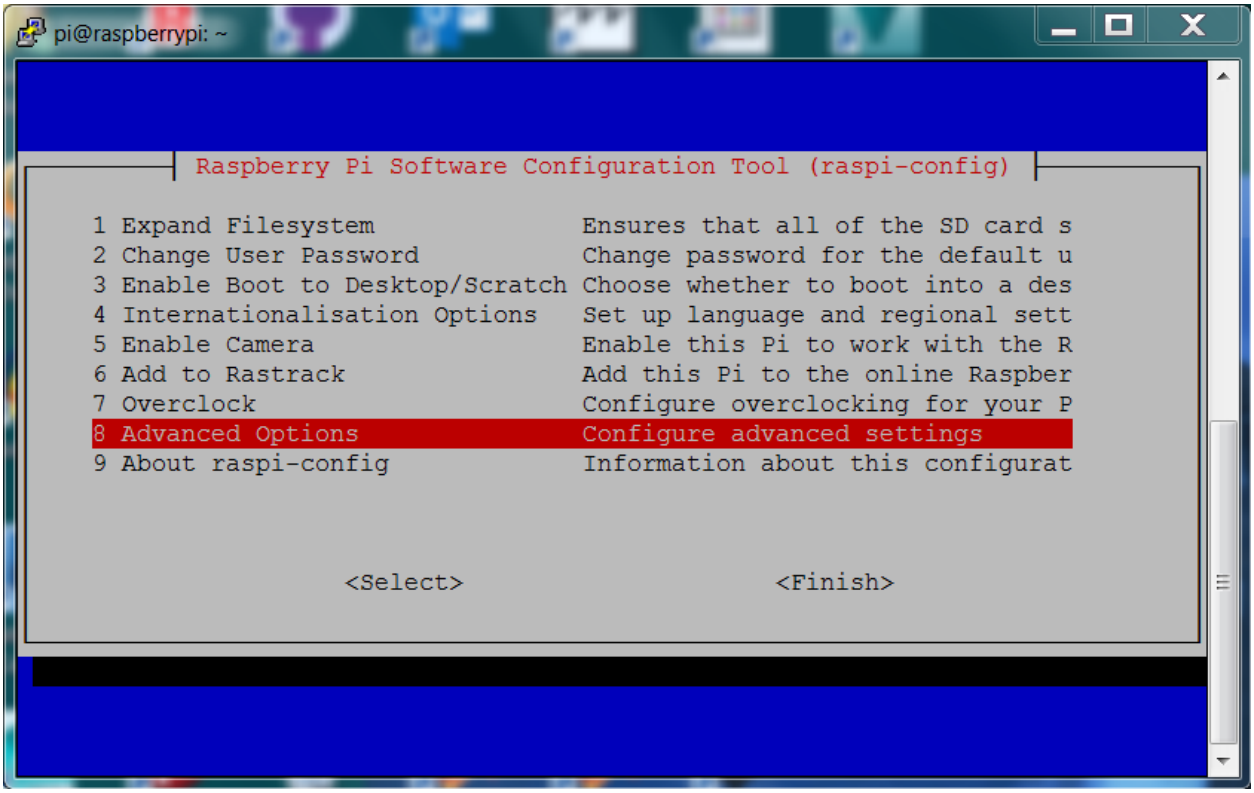

RCTIMER
Multicopter
ESC 40A
Electronic Speed Controller
BEC: Output 5V 3Amp
2-4 LiPo/5-12NiMh
CE RoHS

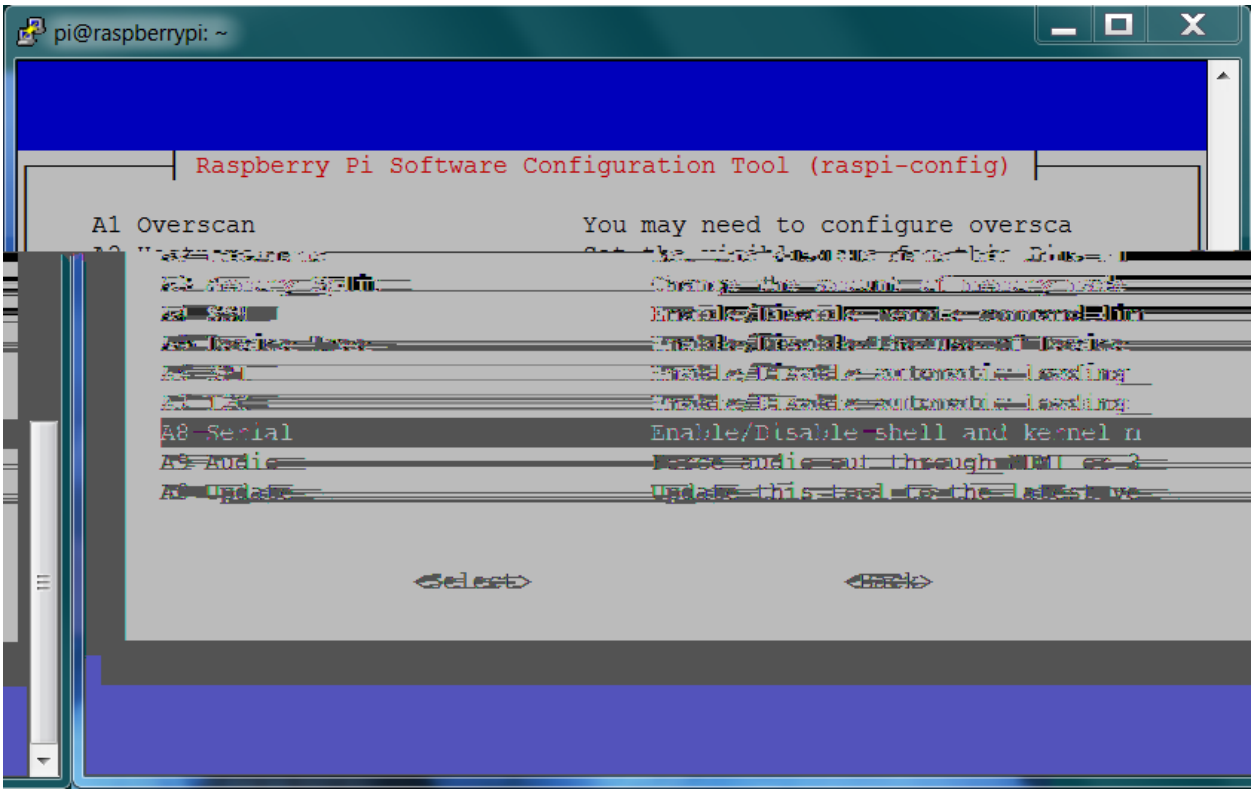

D2836/9

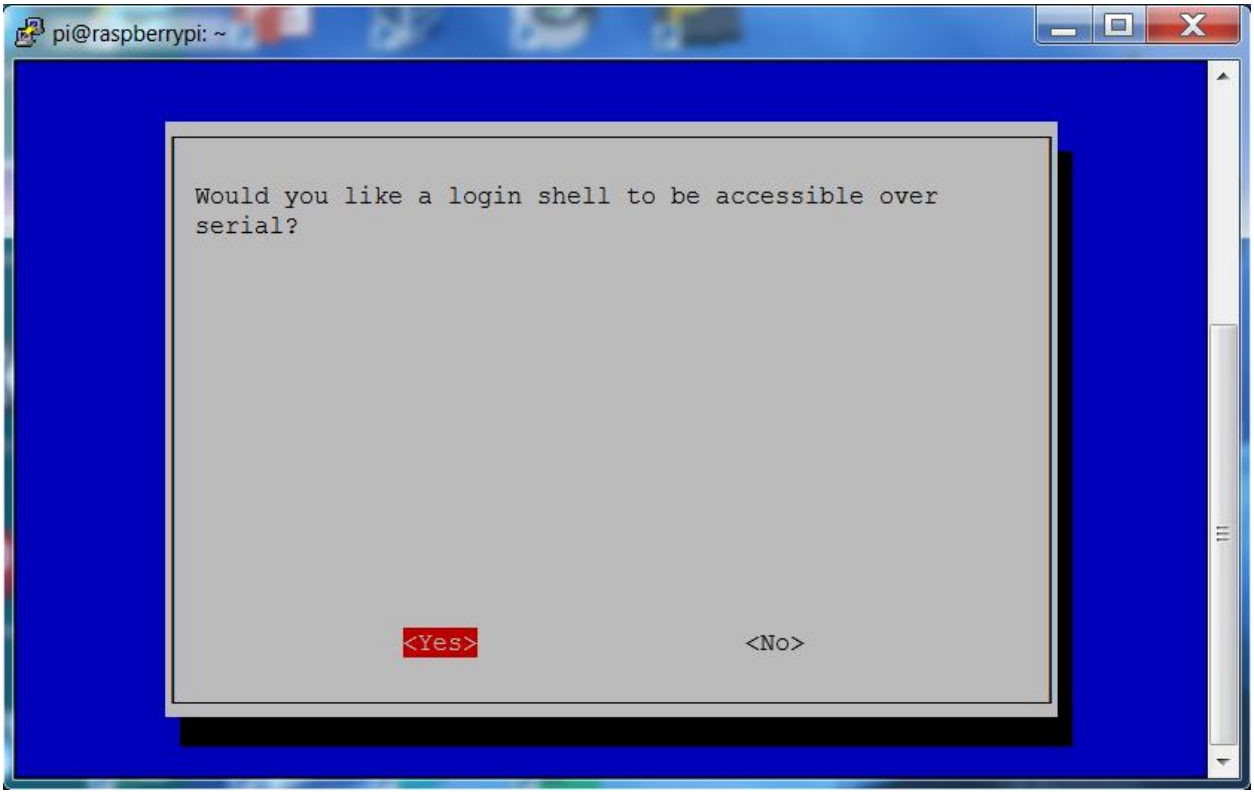

Pixhawk

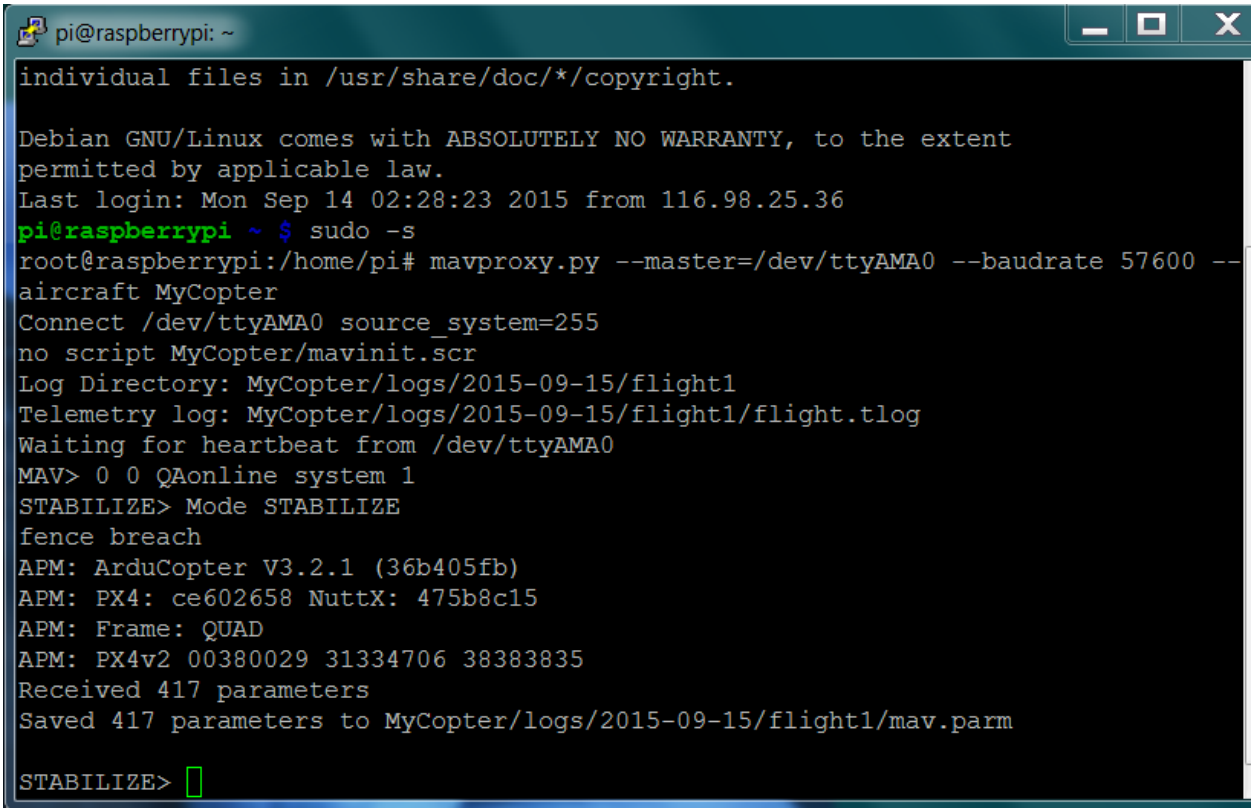

Mission Planner 1.3.31 build 1.1.5696.33420
FLIGHT DATA
FLIGHT PLAN
INITIAL SETUP
CONFIG/TUNING
SIMULATION
TERMINAL
HELP
DONATE
COM64
57600
CONNECT
DISARMED
AS 0.0
GS 0.0
Unknown
GPS: No GPS
Quick
Actions
Gauges
Status
Servo
Telemetry Logs
Altitude (m)
GroundSpeed (m
0.00
0.00
Dist to WP (m)
Yaw (deg)
0.00
0.00
Vertical Speed (m
DistToMAV
0.00
0.00
hdop: 0.0
Sats: 0
Current Heading
Direct to current WP
Target Heading
GPS Track (Black)
©2015 Google - Map data ©2015 Tele Atlas, Imagery ©2015 TerraMetrics
GEO
0.000000 0.000000 0.00m
Auto Pan
Zoom
3.0

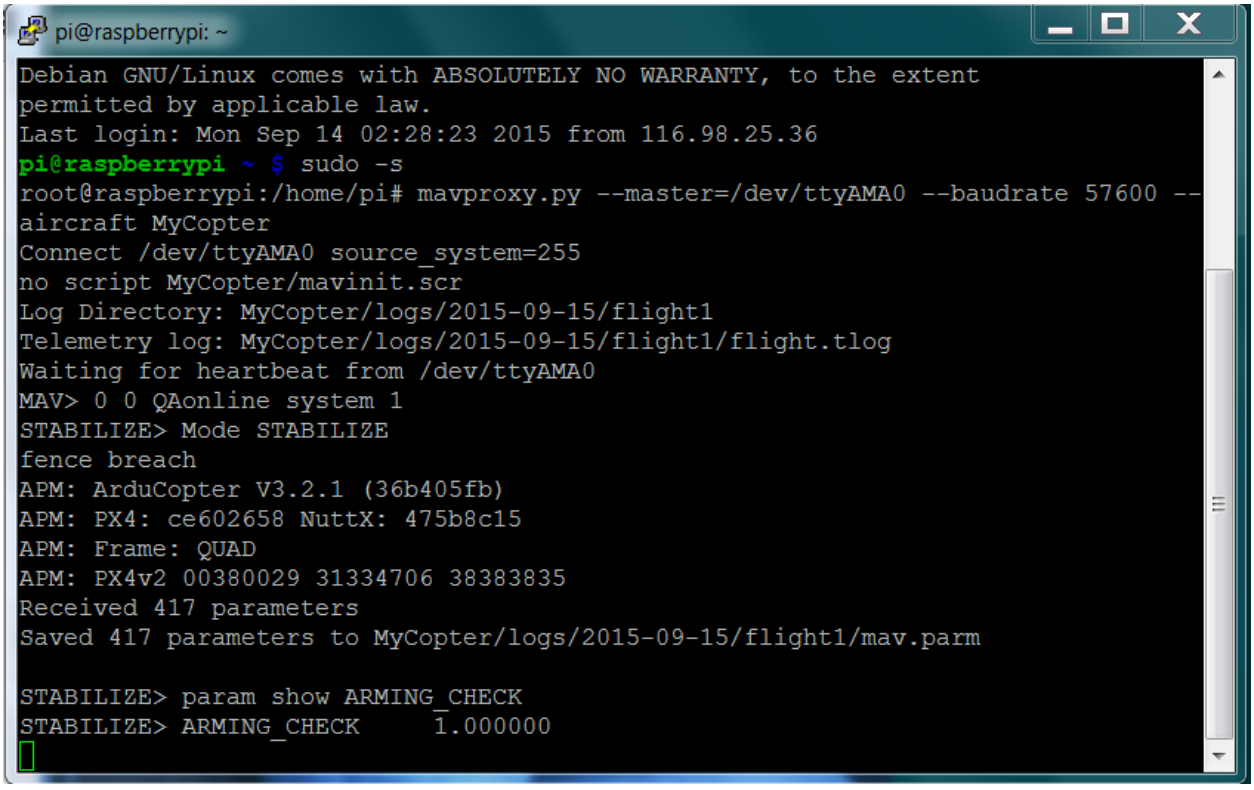

AUX OUT
MAIN OUT
pixhawk
FMU
PWR
B/E
IO
PWR
B/E
ACT
BUZZER
SWITCH
SERIAL 4/5
TELEM 1
GPS
USB
ADC 3.3V
CAN
SPI
I2C
POWER
ADC 6.6V
DSI (DISPLAY)
GPIO
HDMI
CSI (CAMERA)
Audio
ETHERNET
USB 2x
USB 2x
Raspberry Pi Model 2 v1.1
© Raspberry Pi 2014

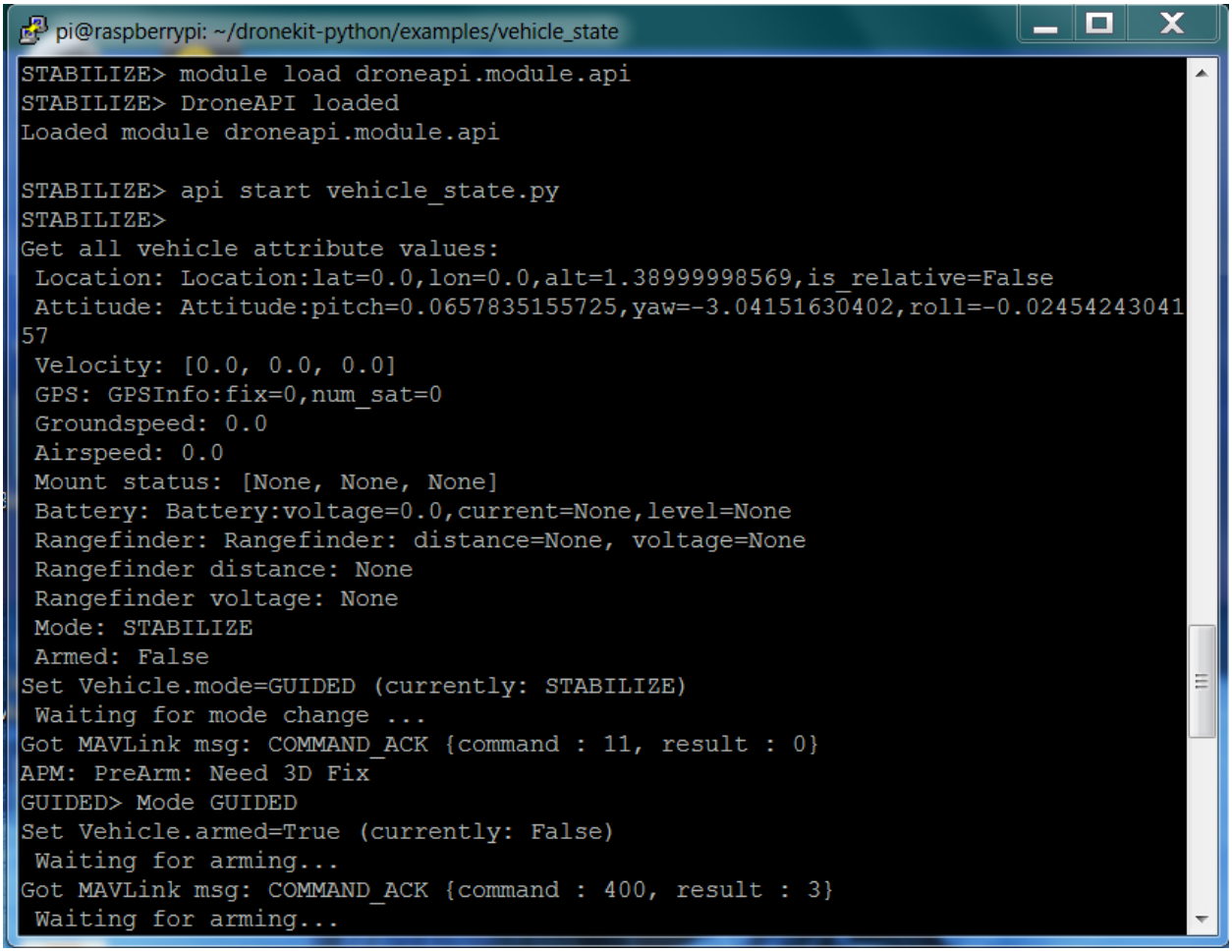

pi@raspberrypi: ~
Raspberry Pi Software Configuration Tool (raspi-config)
1 Expand Filesystem Ensures that all of the SD card s
2 Change User Password Change password for the default u
3 Enable Boot to Desktop/Scratch Choose whether to boot into a des
4 Internationalisation Options Set up language and regional sett
5 Enable Camera Enable this Pi to work with the R
6 Add to Rastrack Add this Pi to the online Raspber
7 Overclock Configure overclocking for your P
8 Advanced Options Configure advanced settings
9 About raspi-config Information about this configurat
<Select>
<Finish>

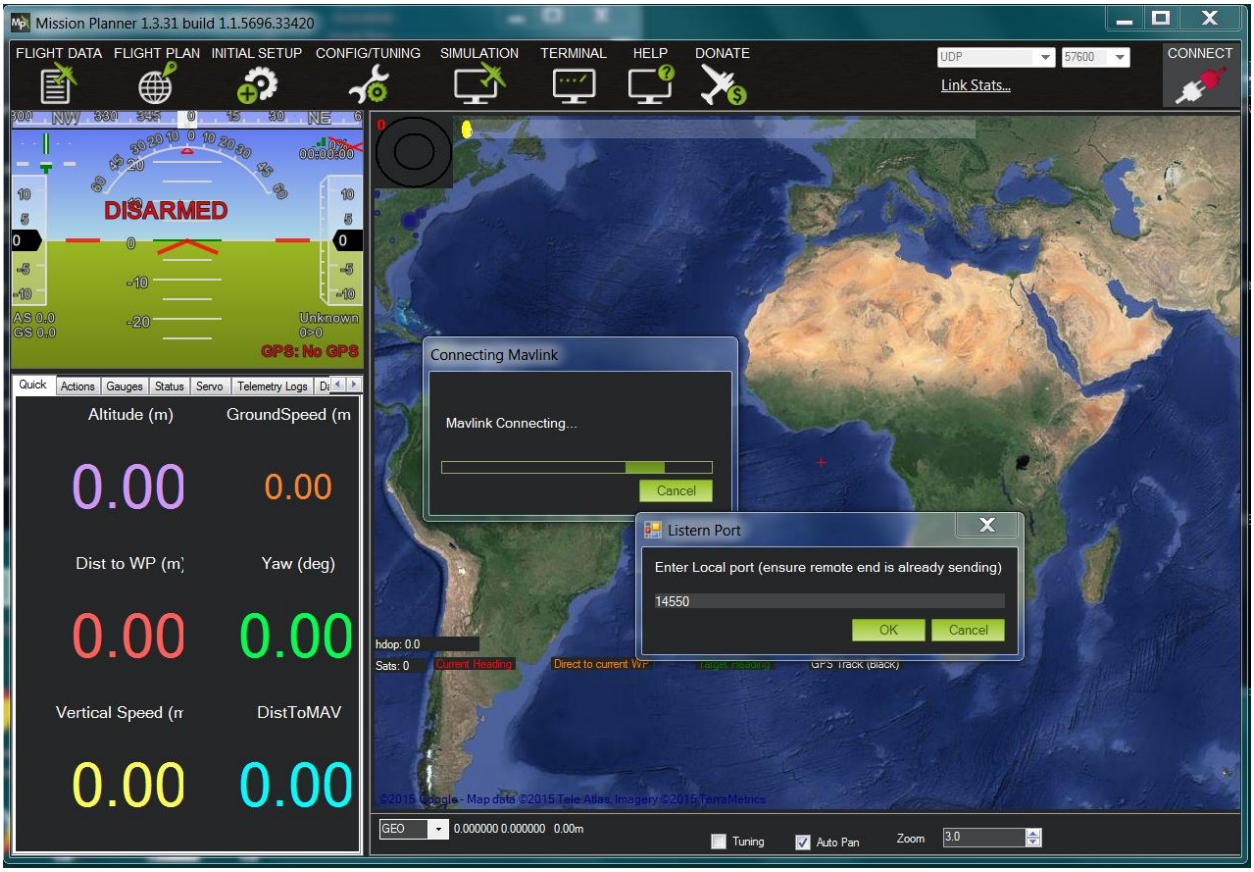

pi@raspberrypi: ~
Raspberry Pi Software Configuration Tool (raspi-config)
A1 Overscan
You may need to configure oversca
A8 Serial
Enable/Disable shell and kernel m
A9 Audio
A0 Update
<Select>
<Back>


pi@raspberrypi: ~
Would you like a login shell to be accessible over serial?
<Yes>
<No>


pi@raspberrypi: ~
individual files in /usr/share/doc/*/copyright.
Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent
permitted by applicable law.
Last login: Mon Sep 14 02:28:23 2015 from 116.98.25.36
pi@raspberrypi ~ $ sudo -s
root@raspberrypi:/home/pi# mavproxy.py --master=/dev/ttyAMA0 --baudrate 57600 --
aircraft MyCopter
Connect /dev/ttyAMA0 source_system=255
no script MyCopter/mavinit.scr
Log Directory: MyCopter/logs/2015-09-15/flight1
Telemetry log: MyCopter/logs/2015-09-15/flight1/flight.tlog
Waiting for heartbeat from /dev/ttyAMA0
MAV> 0 0 QAonline system 1
STABILIZE> Mode STABILIZE
fence breach
APM: ArduCopter V3.2.1 (36b405fb)
APM: PX4: ce602658 NuttX: 475b8c15
APM: Frame: QUAD
APM: PX4v2 00380029 31334706 38383835
Received 417 parameters
Saved 417 parameters to MyCopter/logs/2015-09-15/flight1/mav.parm
STABILIZE>


pi@raspberrypi: ~
Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent
permitted by applicable law.
Last login: Mon Sep 14 02:28:23 2015 from 116.98.25.36
pi@raspberrypi ~ $ sudo -s
root@raspberrypi:/home/pi# mavproxy.py --master=/dev/ttyAMA0 --baudrate 57600 --
aircraft MyCopter
Connect /dev/ttyAMA0 source_system=255
no script MyCopter/mavinit.scr
Log Directory: MyCopter/logs/2015-09-15/flight1
Telemetry log: MyCopter/logs/2015-09-15/flight1/flight.tlog
Waiting for heartbeat from /dev/ttyAMA0
MAV> 0 0 QAonline system 1
STABILIZE> Mode STABILIZE
fence breach
APM: ArduCopter V3.2.1 (36b405fb)
APM: PX4: ce602658 NuttX: 475b8c15
APM: Frame: QUAD
APM: PX4v2 00380029 31334706 38383835
Received 417 parameters
Saved 417 parameters to MyCopter/logs/2015-09-15/flight1/mav.parm
STABILIZE> param show ARMING_CHECK
STABILIZE> ARMING_CHECK 1.000000


pi@raspberrypi: ~/dronekit-python/examples/vehicle_state
STABILIZE> module load droneapi.module.api
STABILIZE> DroneAPI loaded
Loaded module droneapi.module.api
STABILIZE> api start vehicle_state.py
STABILIZE>
Get all vehicle attribute values:
Location: Location:lat=0.0,lon=0.0,alt=1.38999998569,is_relative=False
Attitude: Attitude:pitch=0.0657835155725,yaw=-3.04151630402,roll=-0.02454243041
57
Velocity: [0.0, 0.0, 0.0]
GPS: GPSInfo:fix=0,num_sat=0
Groundspeed: 0.0
Airspeed: 0.0
Mount status: [None, None, None]
Battery: Battery:voltage=0.0,current=None,level=None
Rangefinder: Rangefinder: distance=None, voltage=None
Rangefinder distance: None
Rangefinder voltage: None
Mode: STABILIZE
Armed: False
Set Vehicle.mode=GUIDED (currently: STABILIZE)
Waiting for mode change ...
Got MAVLink msg: COMMAND_ACK {command : 11, result : 0}
APM: PreArm: Need 3D Fix
GUIDED> Mode GUIDED
Set Vehicle.armed=True (currently: False)
Waiting for arming...
Got MAVLink msg: COMMAND_ACK {command : 400, result : 3}
Waiting for arming...


Mission Planner 1.3.31 build 1.1.5696.33420
FLIGHT DATA
FLIGHT PLAN
INITIAL SETUP
CONFIG/TUNING
SIMULATION
TERMINAL
HELP
DONATE
UDP
57600
CONNECT
Link Stats...
DISARMED
AS 0.0
GS 0.0
Unknown
GPS: No GPS
Quick
Actions
Gauges
Status
Servo
Telemetry Logs
Altitude (m)
GroundSpeed (m
0.00
0.00
Dist to WP (m)
Yaw (deg)
0.00
0.00
Vertical Speed (m
DistToMAV
0.00
0.00
Connecting Mavlink
Mavlink Connecting...
Cancel
Listern Port
Enter Local port (ensure remote end is already sending)
14550
OK
Cancel
hdop: 0.0
Sats: 0
Current Heading
Direct to current WP
Target Heading
GPS Track (black)
©2015 Google - Map data ©2015 Tele Atlas, Imagery ©2015 TerraMetrics
GEO
0.000000 0.000000 0.00m
Tuning
Auto Pan
Zoom
3.0