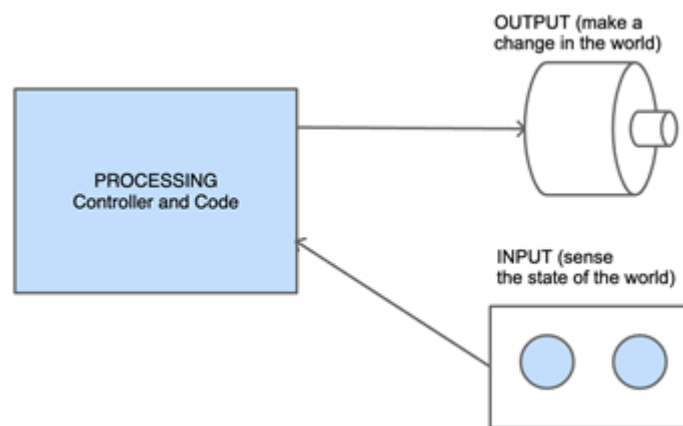
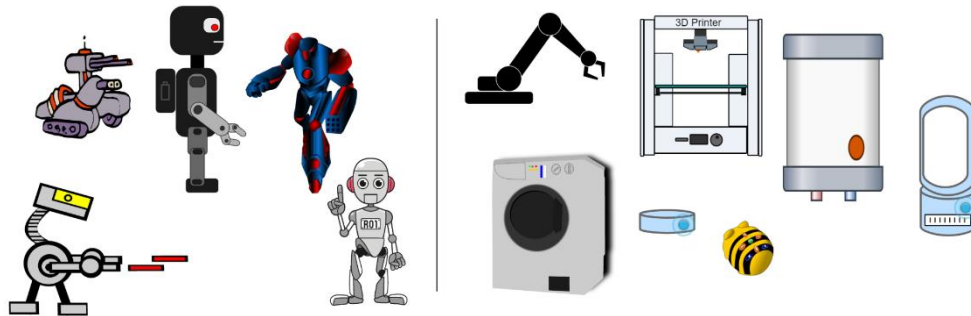
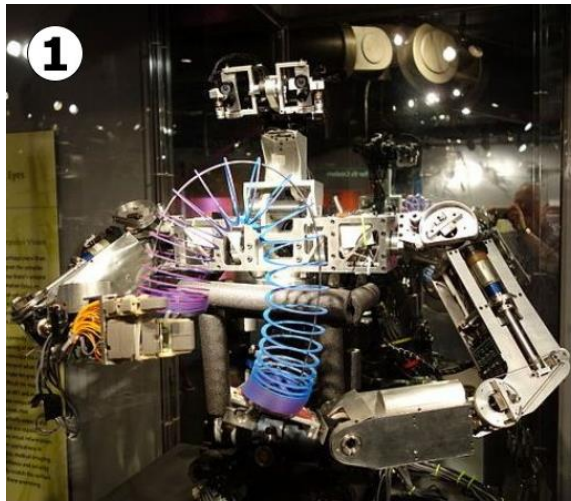
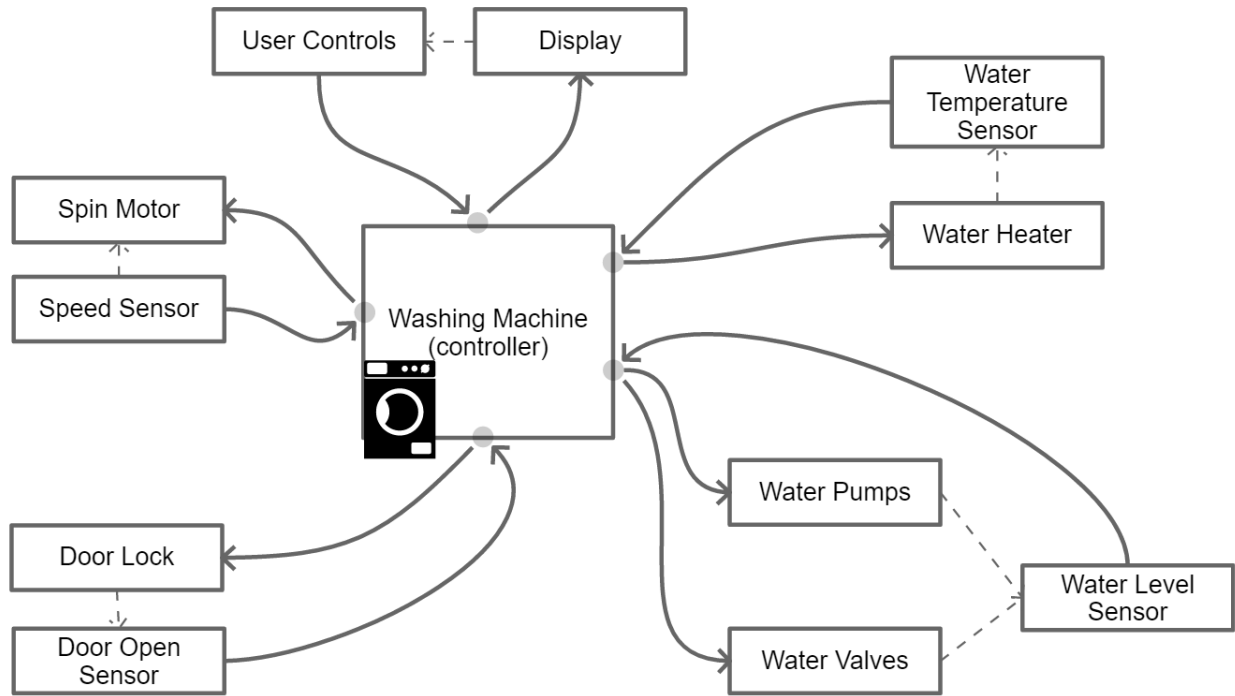


Chapter 1: Introduction to Robotics

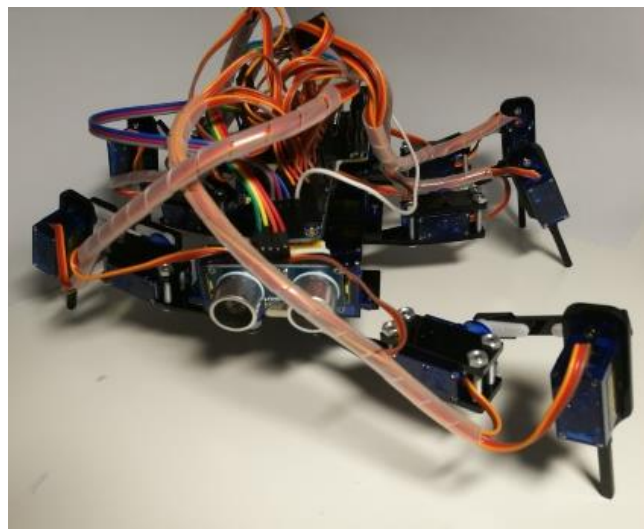
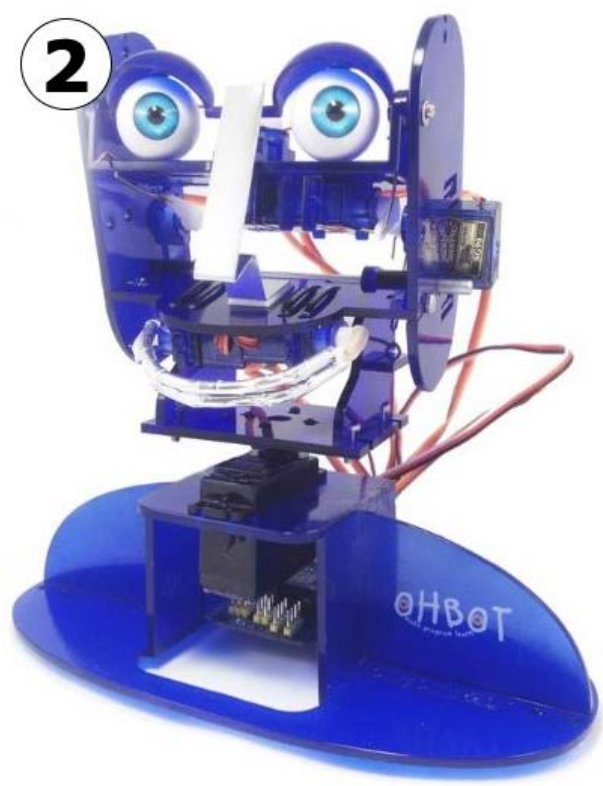
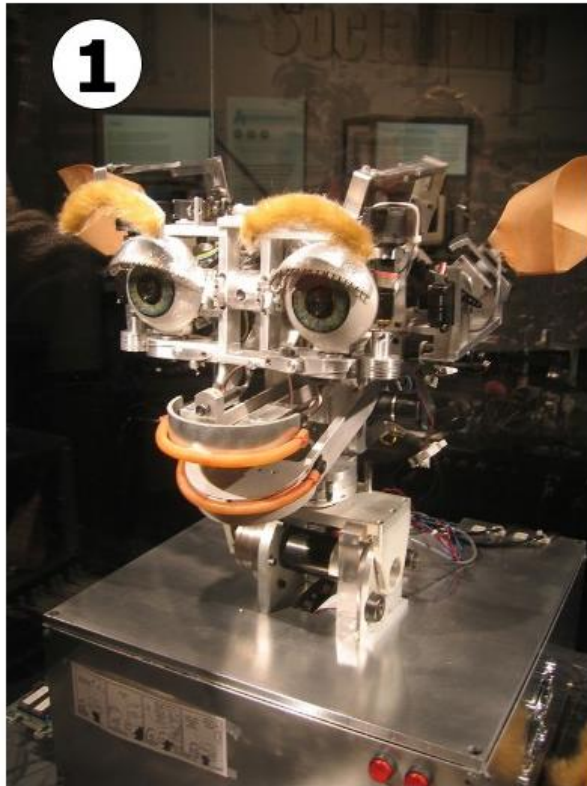


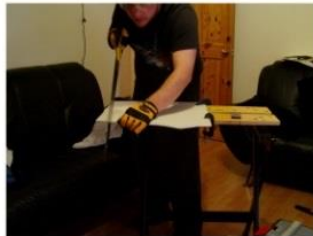
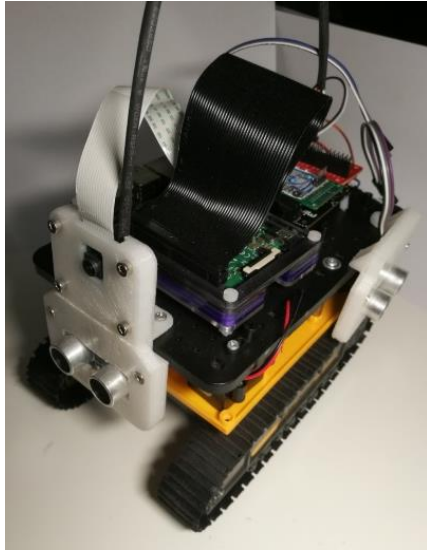




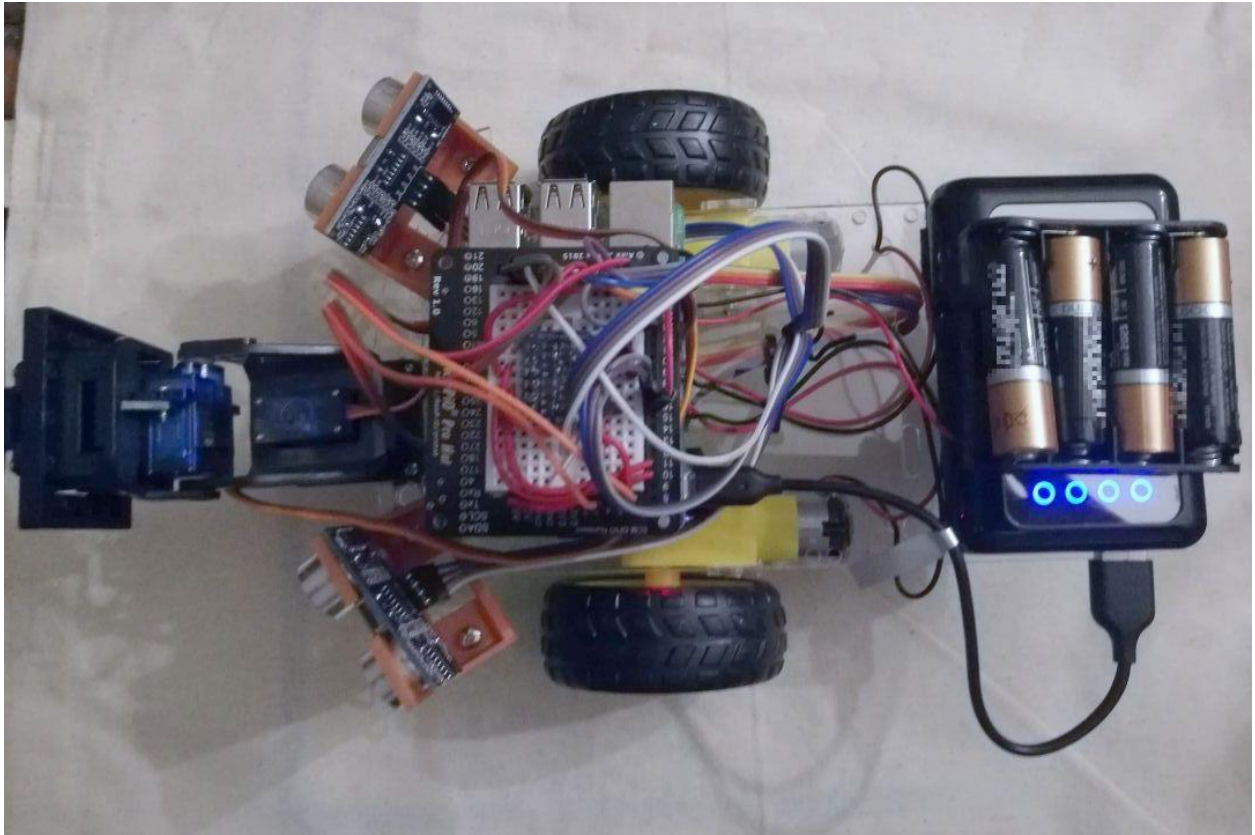


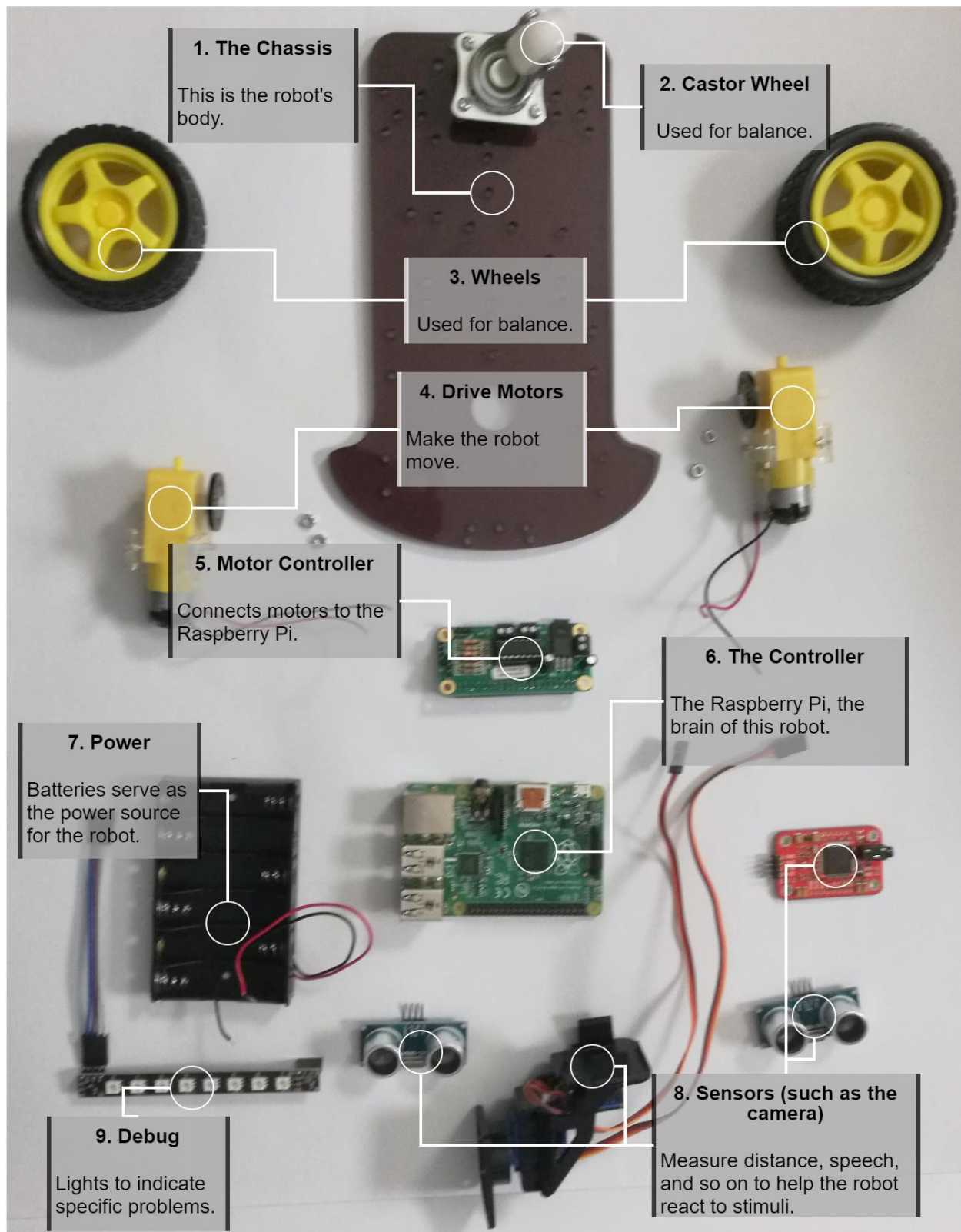


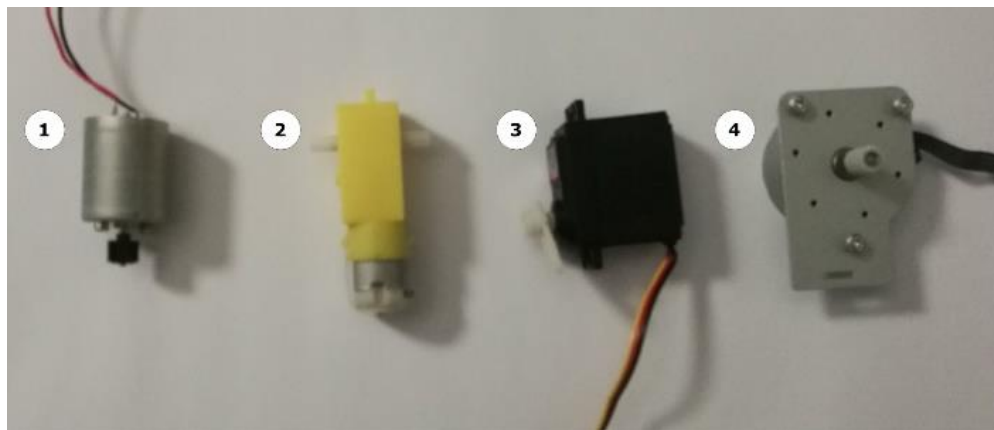
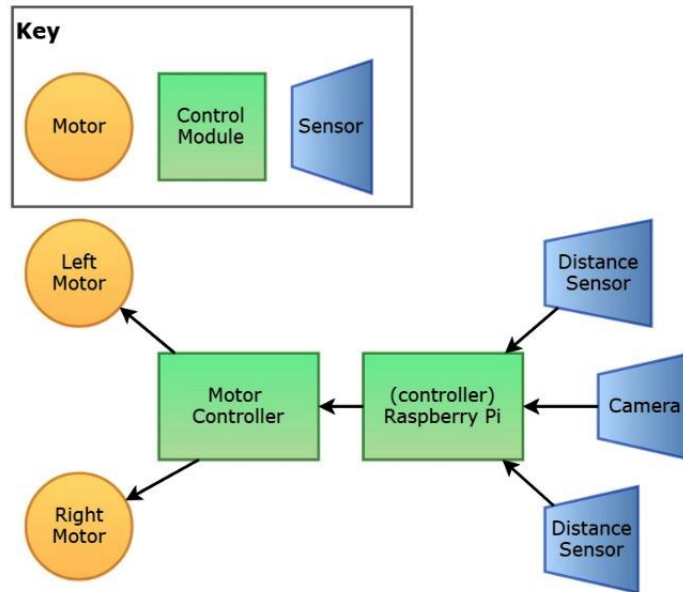


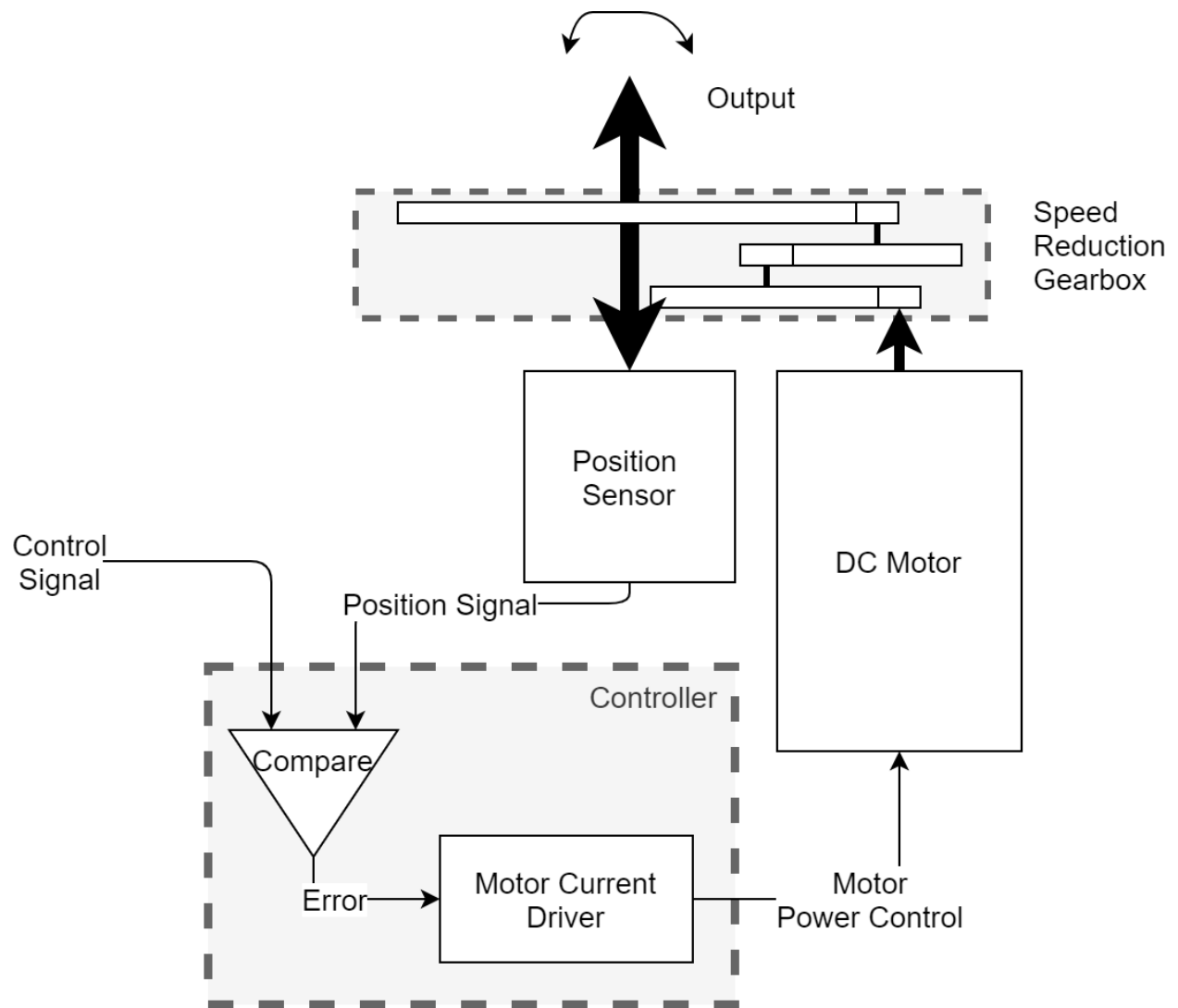


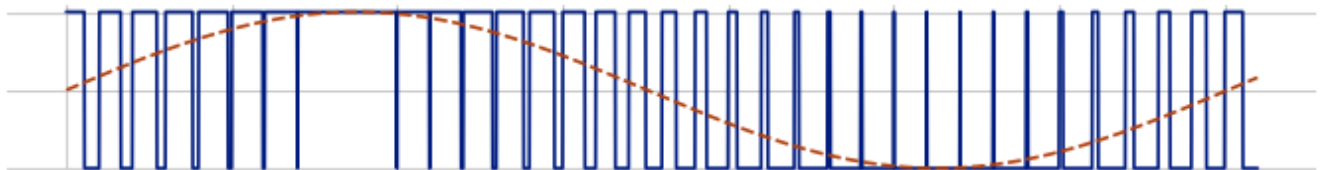
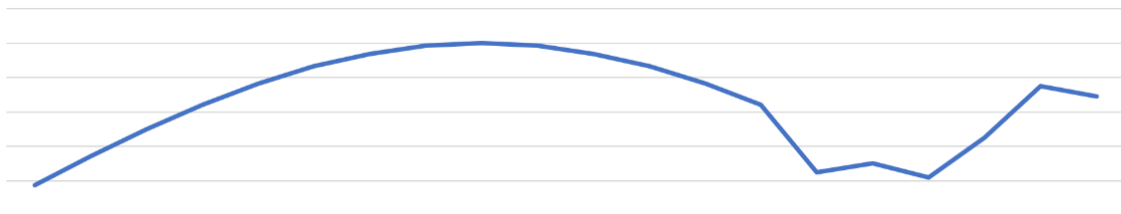
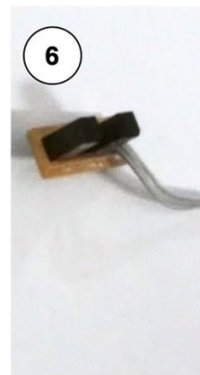
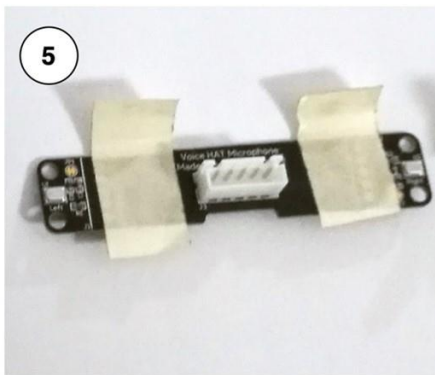
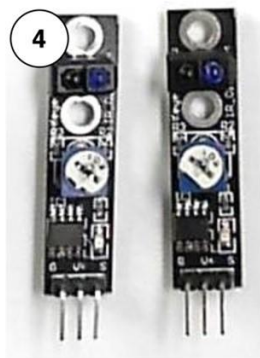
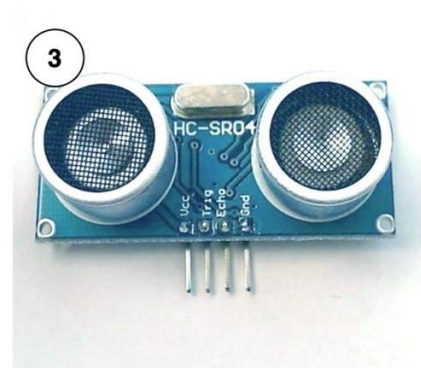
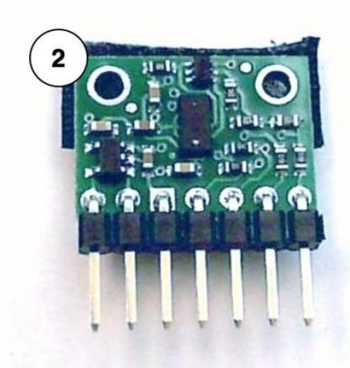
Chapter 2: Exploring Robot Building Blocks – Code and Electronics

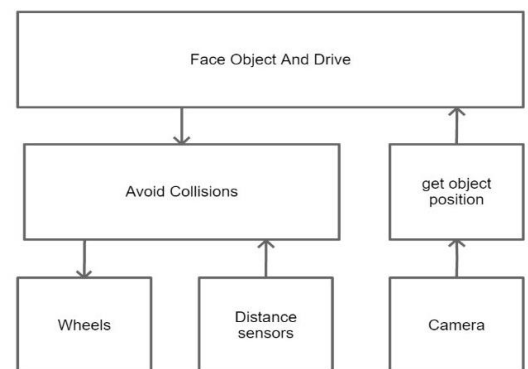
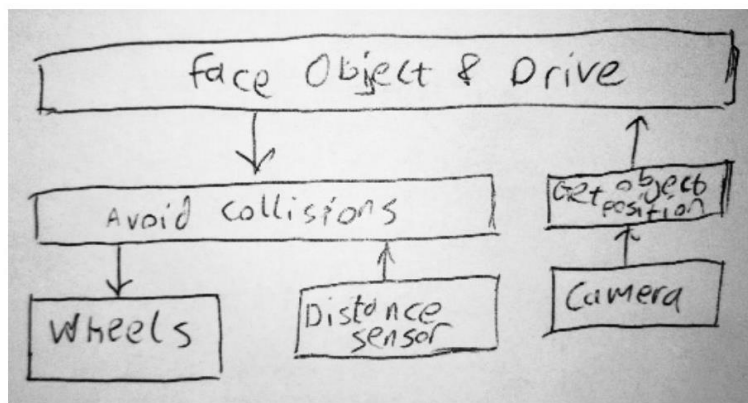
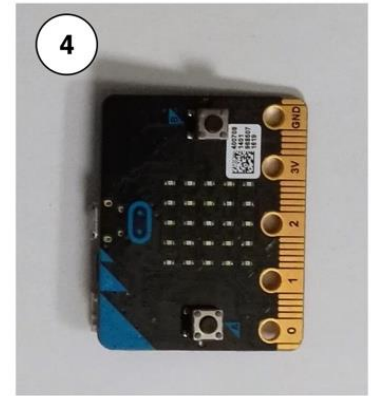
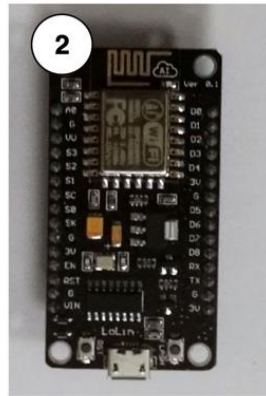


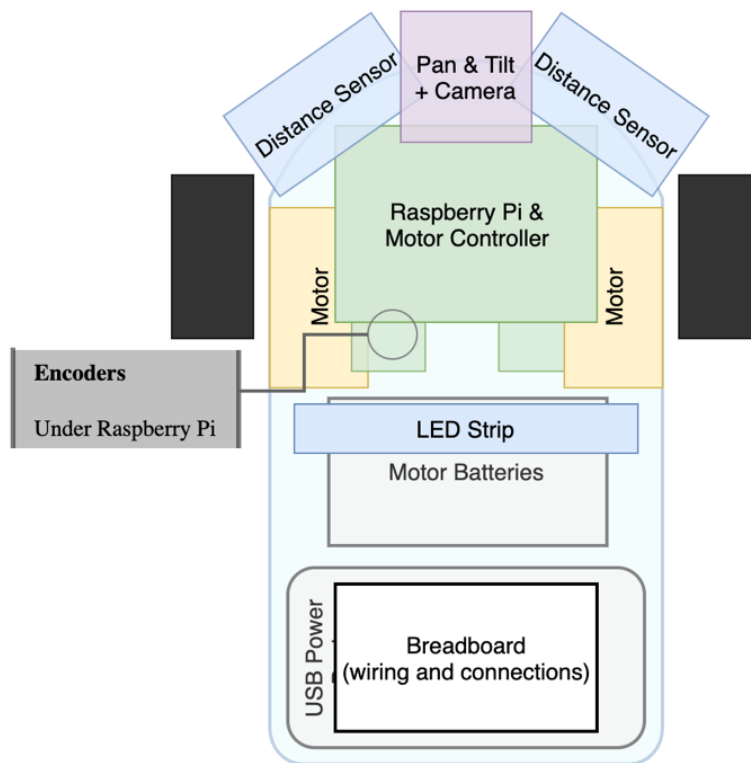
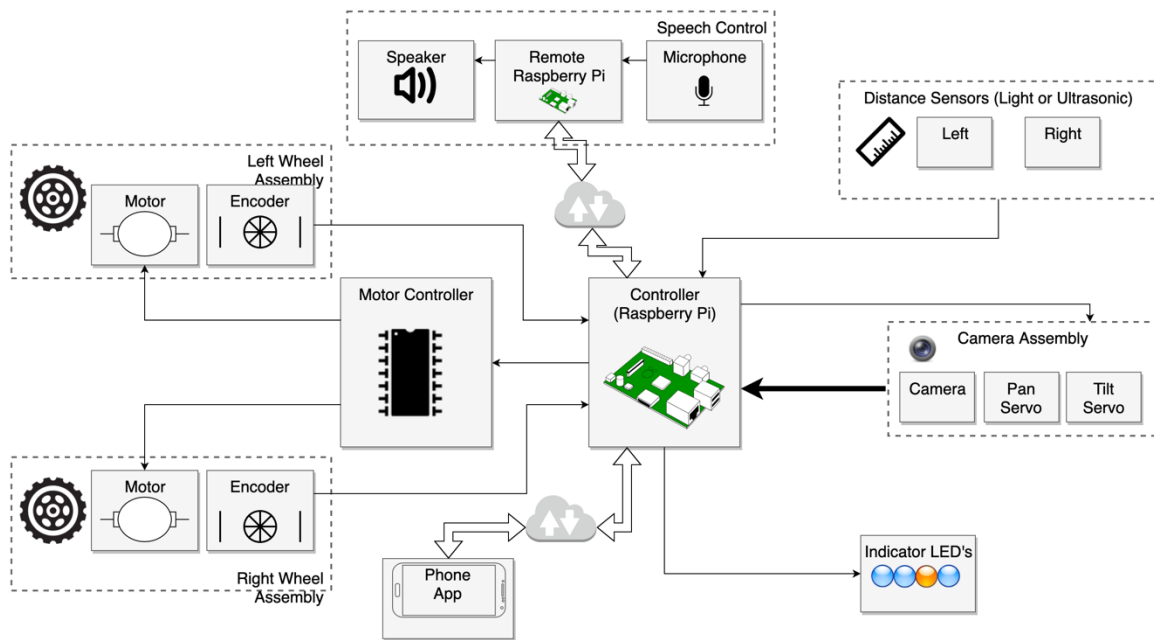




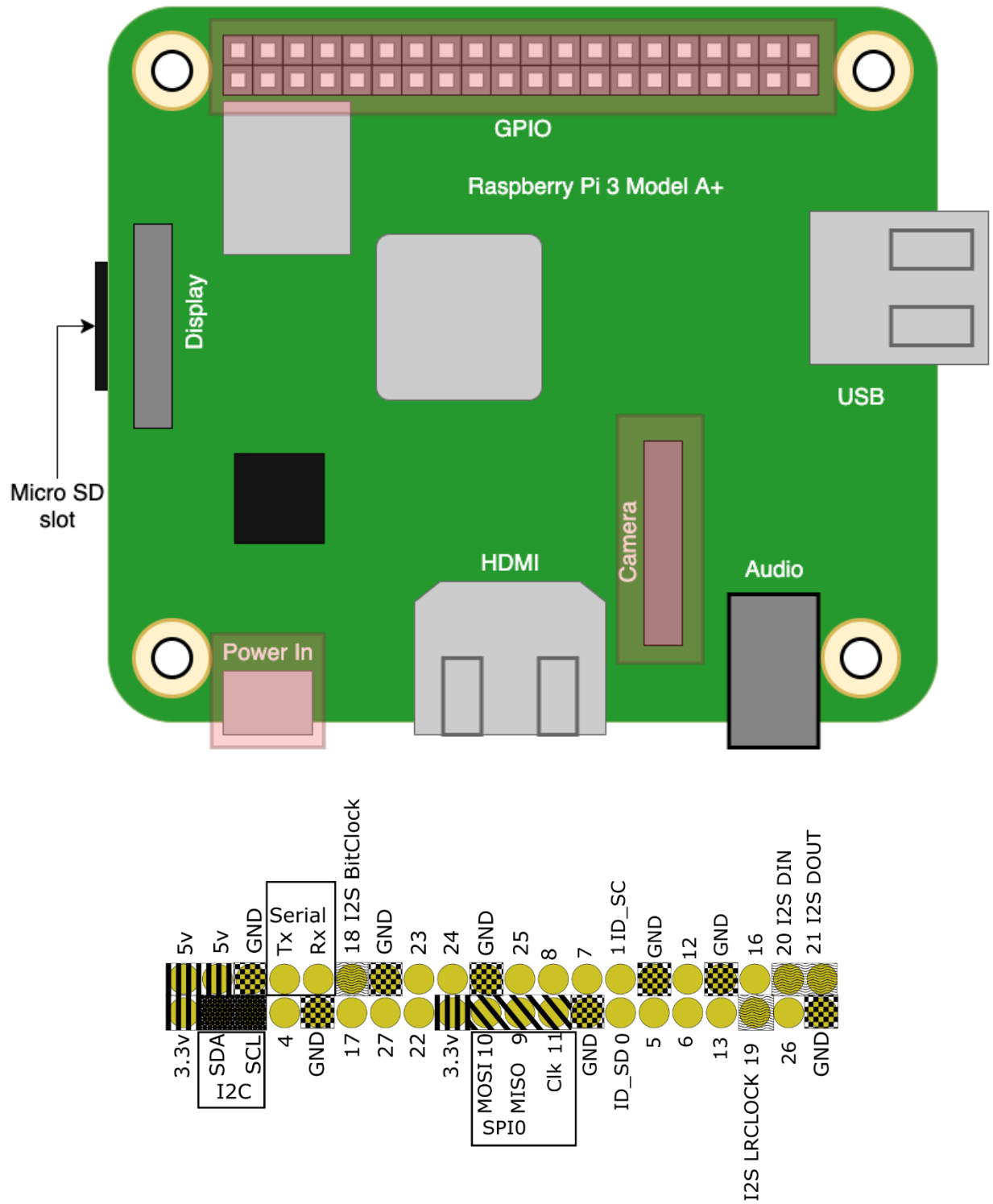








Chapter 3: Exploring the Raspberry Pi



Download for macOS

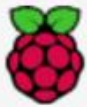
[Download for Windows](#)

[Download for Ubuntu for x86](#)

To install on **Raspberry Pi OS**, type
`sudo apt install rpi-imager`
in a Terminal window.

Operating System

CHOOSE OS



Raspberry Pi OS (other)

Other Raspberry Pi OS based images



LibreELEC



Raspberry Pi OS Lite (32-bit)

A port of Debian with no desktop environment

Released: 2020-08-20

Online - 0.4 GB download

Raspberry Pi OS Full (32-bit)

SD Card

CHOOSE SD CARD

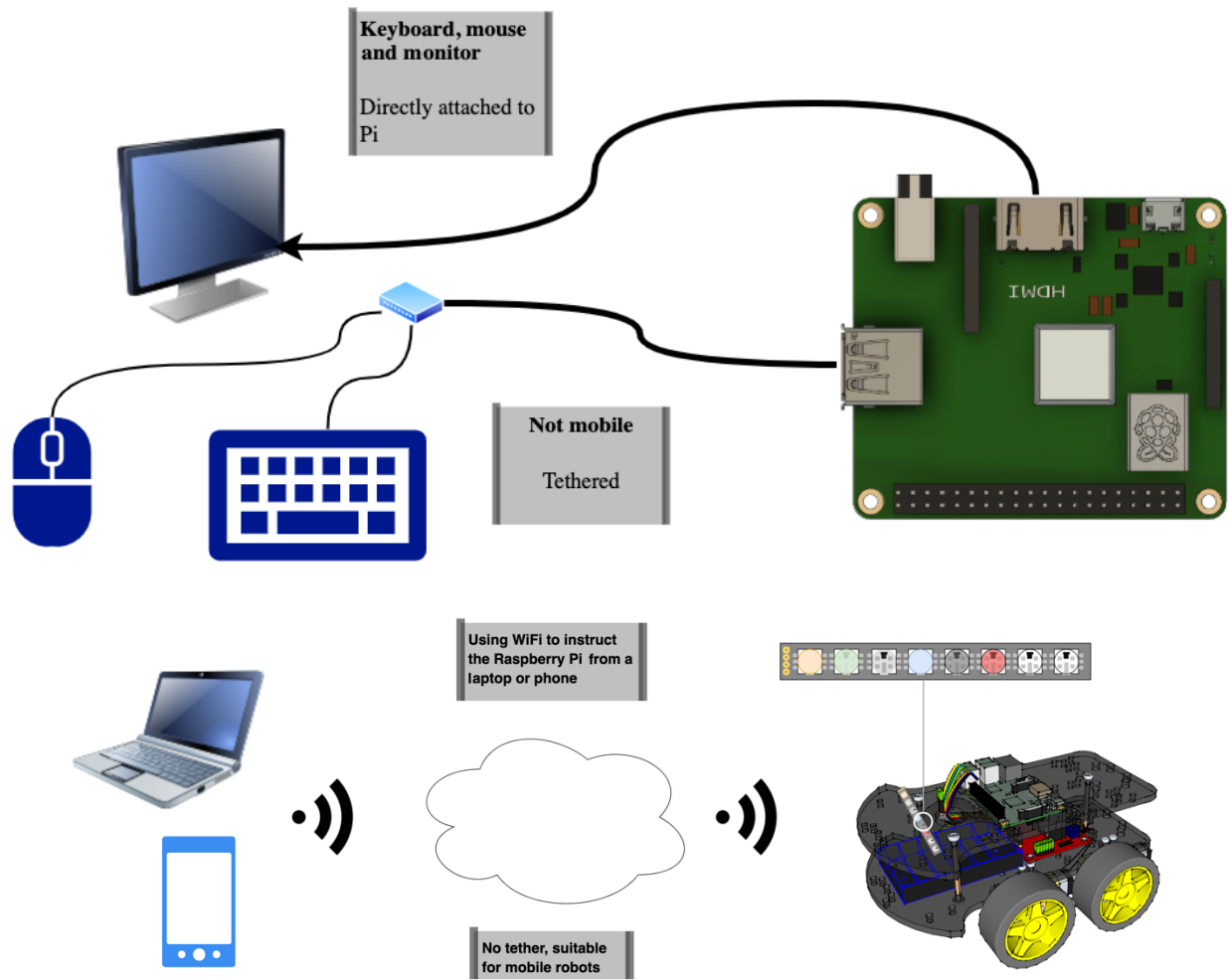


Generic STORAGE DEVICE Media - 7.9 GB

Mounted as /Volumes/boot

WRITE

Chapter 4: Preparing a Headless Raspberry Pi for a Robot



Category:

- Session
 - Logging
- Terminal
 - Keyboard
 - Bell
 - Features
- Window
 - Appearance
 - Behaviour
 - Translation
 - Selection
 - Colours
- Connection
 - Data
 - Proxy
 - Telnet
 - Rlogin
 - SSH**
 - Serial

Basic options for your PuTTY session

Specify the destination you want to connect to

Host Name (or IP address) Port

Connection type:

☐ Raw
 ☐ Telnet
 ☐ Rlogin
 ☒ SSH
 ☐ Serial

Load, save or delete a stored session

Saved Sessions

Default Settings
 armbot
 esp-mode
 orionrobots-ap
 orionrobots_host
 orionscrollpi
 skittlebot

Close window on exit:

☐ Always
 ☐ Never
 ☒ Only on clean exit

pi@raspberrypi: ~

```
login as: pi
pi@raspberrypi.local's password:
Linux raspberrypi 4.14.34-v7+ #1110 SMP Mon Apr 16 15:18:51 BST 2018 armv7l

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: Tue Jun  5 21:34:37 2018 from fe80::28f3:116a:7c86:26f0%wlan0

SSH is enabled and the default password for the 'pi' user has not been changed.
This is a security risk - please login as the 'pi' user and type 'passwd' to set
a new password.

pi@raspberrypi:~ $
```

pi@raspberrypi: ~

Raspberry Pi 3 Model B Plus Rev 1.3

Raspberry Pi Software Configuration Tool (raspi-config)

- | | |
|---------------------------|------------------------------------|
| 1 Change User Password | Change password for the current u |
| 2 Network Options | Configure network settings |
| 3 Boot Options | Configure options for start-up |
| 4 Localisation Options | Set up language and regional sett |
| 5 Interfacing Options | Configure connections to peripher |
| 6 Overclock | Configure overclocking for your P |
| 7 Advanced Options | Configure advanced settings |
| 8 Update | Update this tool to the latest ve |
| 9 About raspi-config | Information about this configurat |

<Select>

<Finish>

pi@raspberrypi: ~

Raspberry Pi 3 Model B Plus Rev 1.3

Raspberry Pi Software Configuration Tool (raspi-config)

- | | |
|--------------------------|-----------------------------------|
| 1 Change User Password | Change password for the current u |
| 2 Network Options | Configure network settings |
| 3 Boot Options | Configure options for start-up |
| 4 Localisation Options | Set up language and regional sett |
| 5 Interfacing Options | Configure connections to peripher |
| 6 Overclock | Configure overclocking for your P |
| 7 Advanced Options | Configure advanced settings |
| 8 Update | Update this tool to the latest ve |
| 9 About raspi-config | Information about this configurat |

<Select>

<Finish>

pi@raspberrypi: ~

Raspberry Pi Software Configuration Tool (raspi-config)

N1 Hostname	Set the visible name for this Pi
N2 Wi-fi	Enter SSID and passphrase
N3 Network interface names	Enable/Disable predictable network

<Select> <Back>

pi@raspberrypi: ~

Raspberry Pi 3 Model B Plus Rev 1.3

Raspberry Pi Software Configuration Tool (raspi-config)

1 Change User Password	Change password for the current user
2 Network Options	Configure network settings
3 Boot Options	Configure options for start-up
4 Localisation Options	Set up language and regional settings
5 Interfacing Options	Configure connections to peripherals
6 Overclock	Configure overclocking for your Pi
7 Advanced Options	Configure advanced settings
8 Update	Update this tool to the latest version
9 About raspi-config	Information about this configuration tool

<Select> <Finish>

```
pi@raspberrypi: ~  
Raspberry Pi 3 Model B Plus Rev 1.3  
Raspberry Pi Software Configuration Tool (raspi-config)  
1 Change User Password      Change password for the current u  
2 Network Options           Configure network settings  
3 Boot Options              Configure options for start-up  
4 Localisation Options      Set up language and regional sett  
5 Interfacing Options        Configure connections to peripher  
6 Overclock                 Configure overclocking for your P  
7 Advanced Options          Configure advanced settings  
8 Update                    Update this tool to the latest ve  
9 About raspi-config         Information about this configurat  
  
      <Select>                <Finish>
```

```
pi@raspberrypi: ~  
Would you like to reboot now?  
  
      <Yes>                   <No>
```

PuTTY Fatal Error



Server unexpectedly closed network connection

OK

Specify the destination you want to connect to

Host Name (or IP address)

myrobot.local

Port

22

Connection type:

☐ Raw

☐ Telnet

☐ Rlogin

☒ SSH

☐ Serial

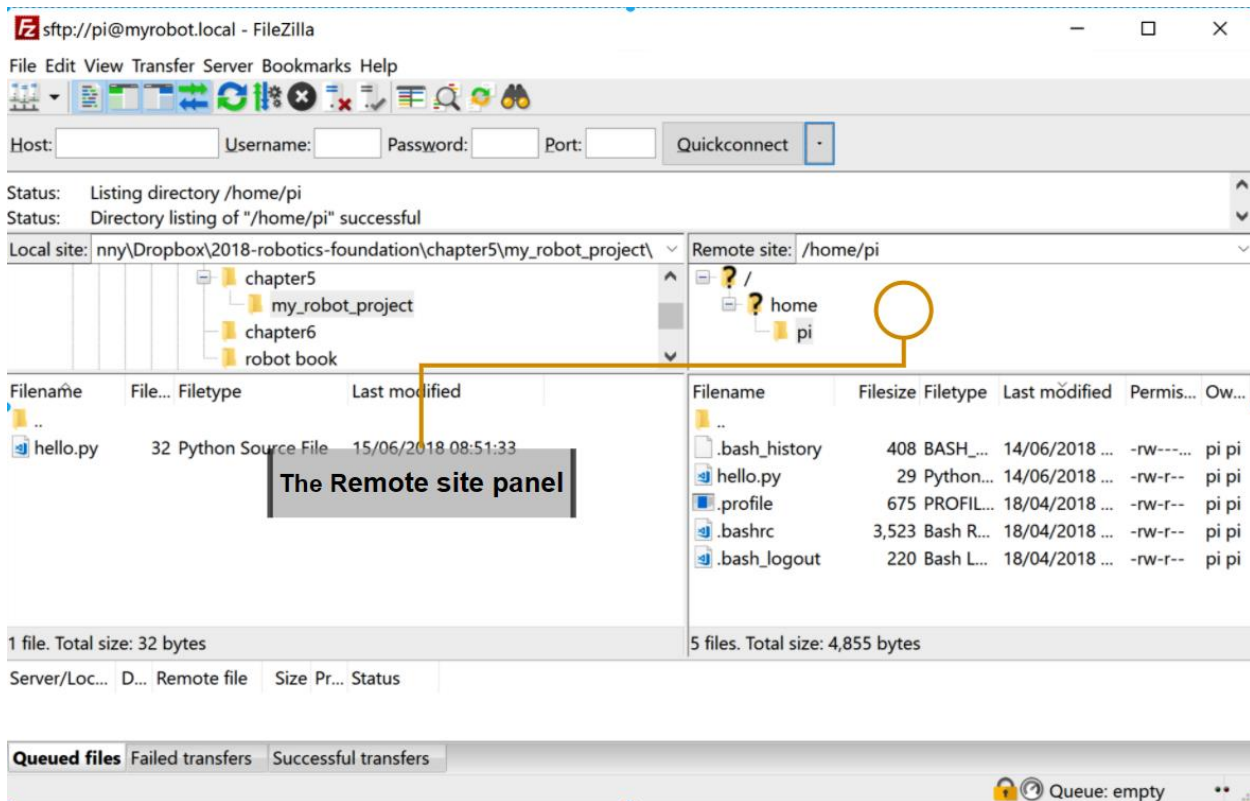
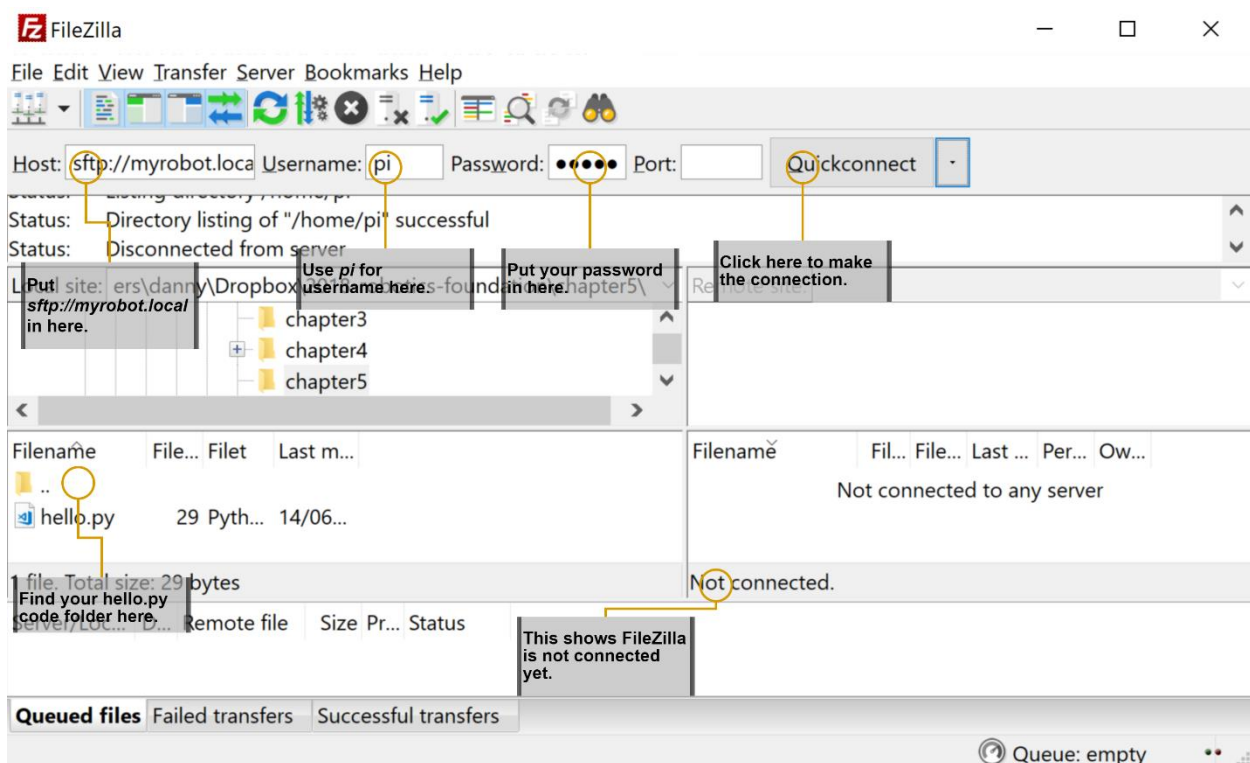
pi@myrobot: ~

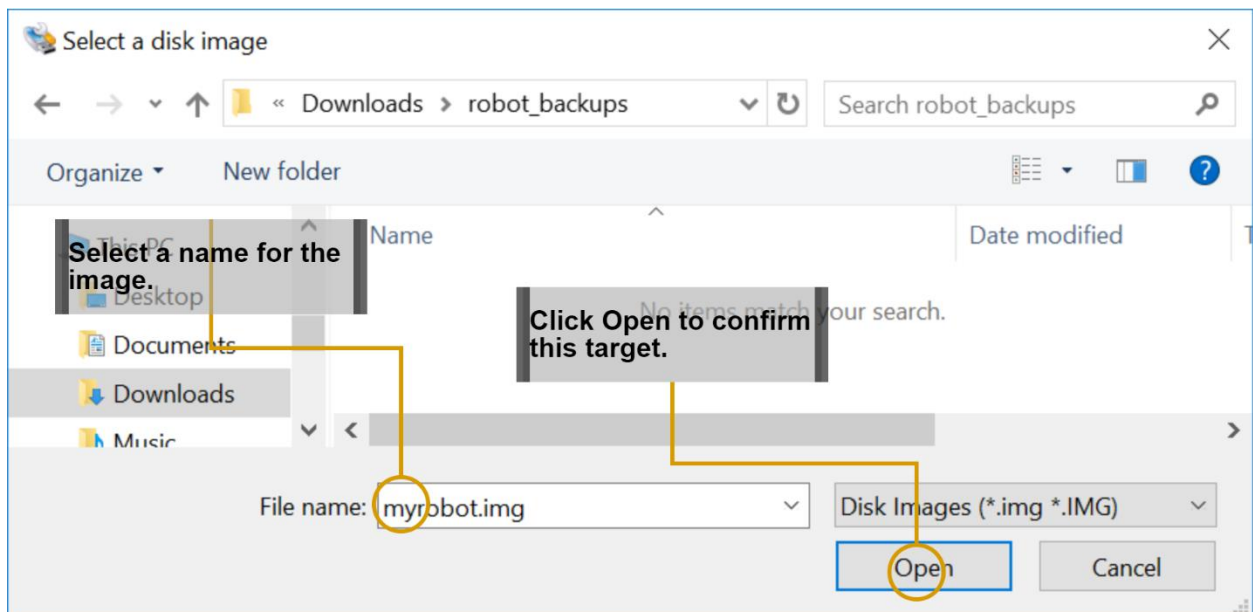
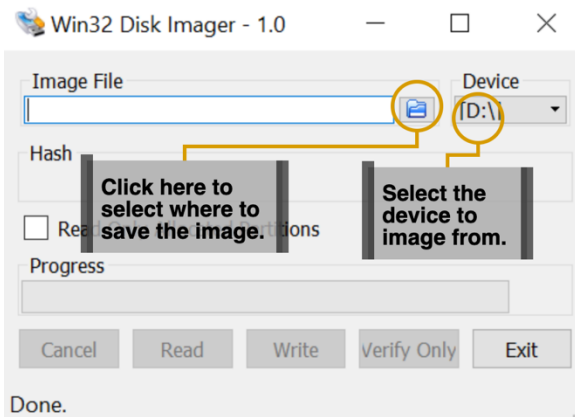
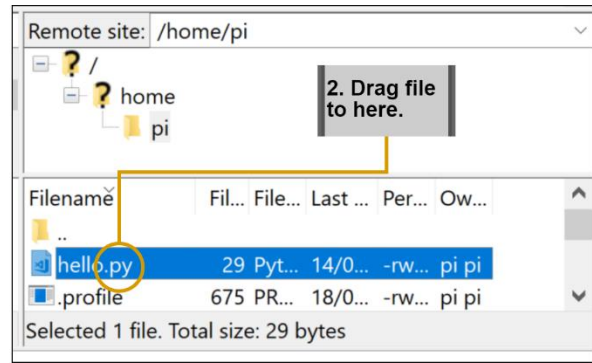
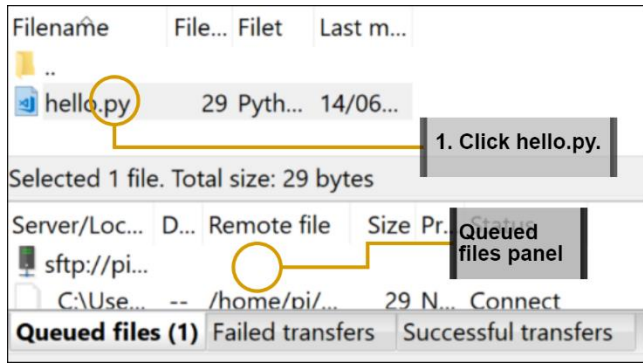
```
login as: pi
pi@myrobot.local's password:
Linux myrobot 4.14.34-v7+ #1110 SMP Mon Apr 16 15:18:51 BST 2018 armv7l

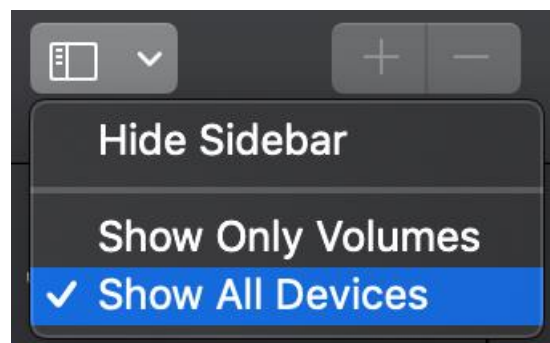
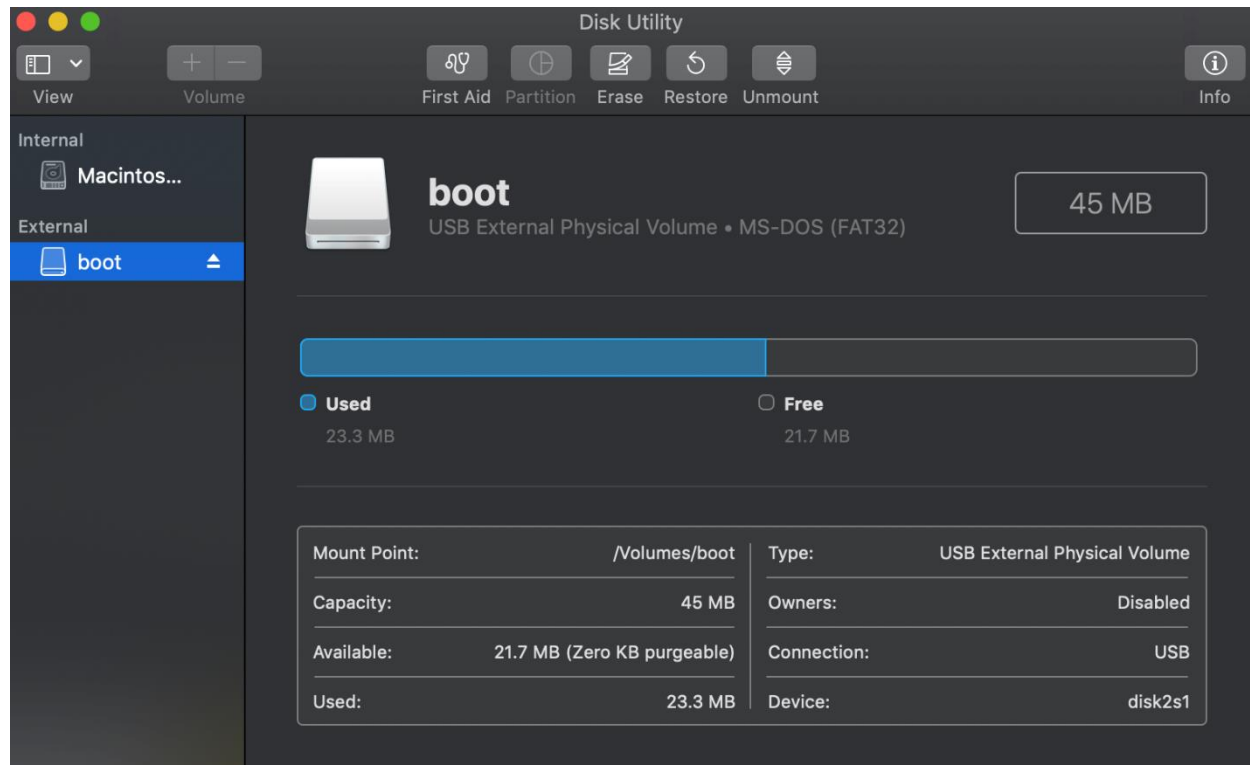
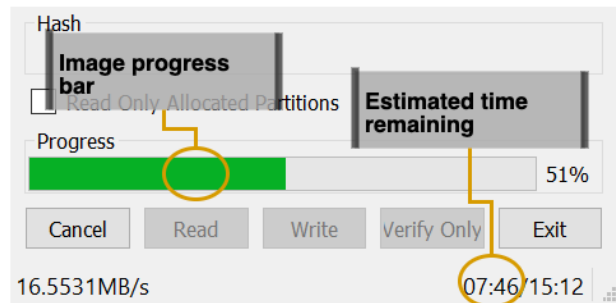
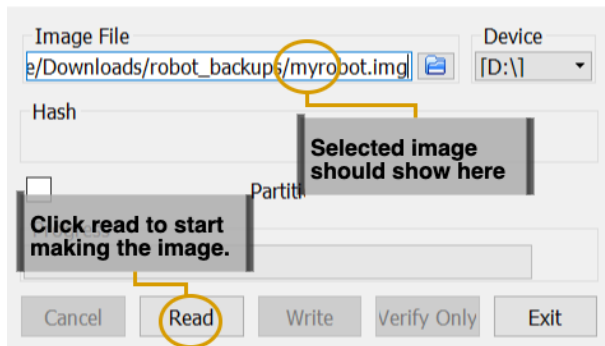
The programs included with the Debian GNU/Linux system are free software;
the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*/copyright.

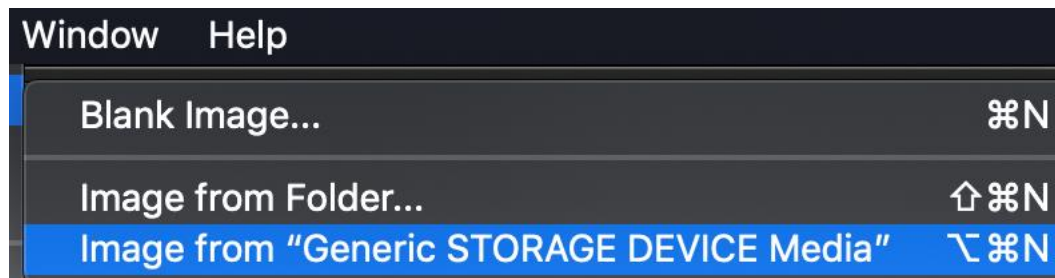
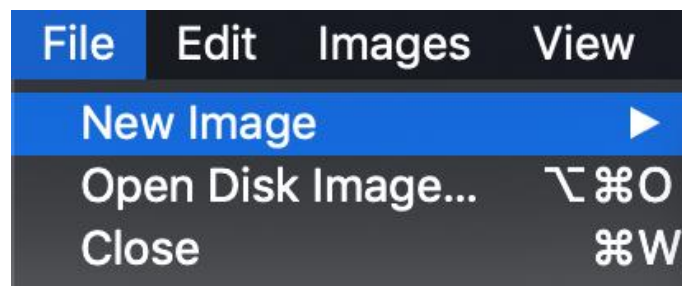
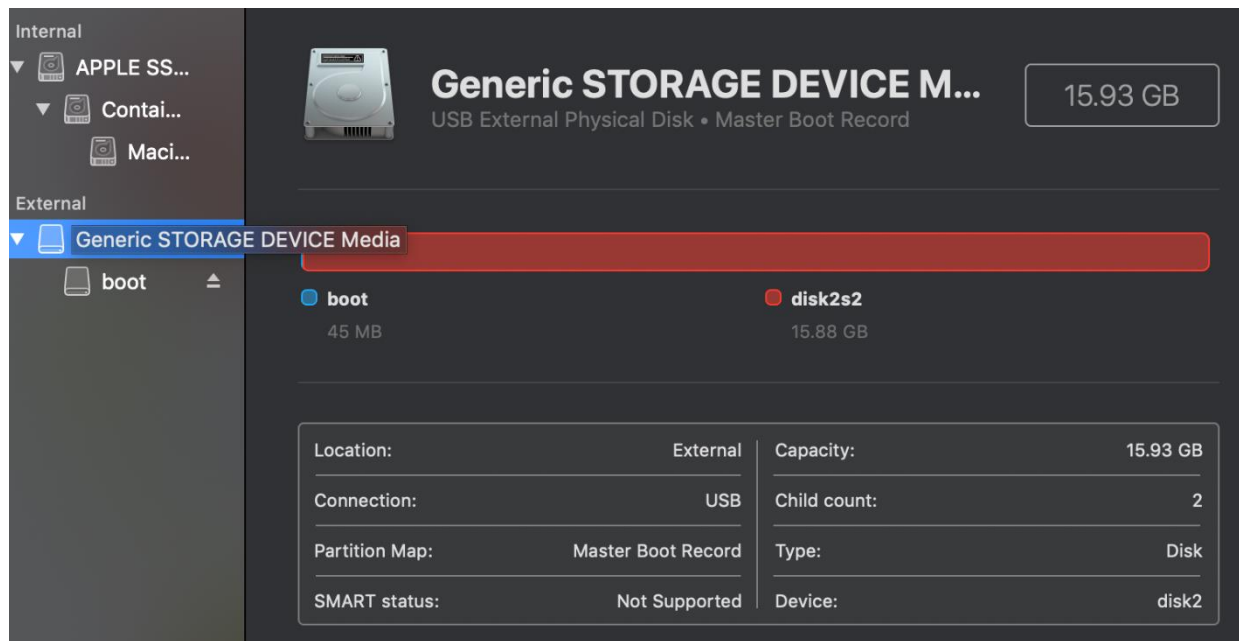
Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent
permitted by applicable law.
Last login: Wed Jun  6 20:54:12 2018 from fe80::28f3:116a:7c86:26f0%wlan0
pi@myrobot:~$ df -h
Filesystem      Size  Used Avail Use% Mounted on
/dev/root        15G 1022M   13G   8% /
devtmpfs         460M    0  460M   0% /dev
tmpfs            464M    0  464M   0% /dev/shm
tmpfs            464M   12M  452M   3% /run
tmpfs            5.0M  4.0K   5.0M   1% /run/lock
tmpfs            464M    0  464M   0% /sys/fs/cgroup
/dev/mmcblk0p1   43M   22M   21M  51% /boot
tmpfs            93M    0   93M   0% /run/user/1000
pi@myrobot:~$
```

Chapter 5: Backing Up the Code with Git and SD Card Copies









First Aid Partition Erase Restore Mount

Save As: Generic STORAGE DEVICE Media

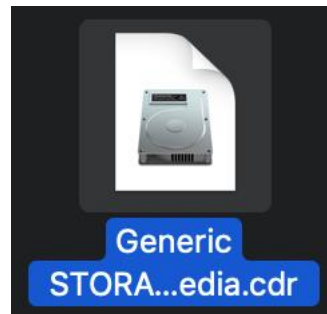
Tags:

Where: Documents

Format: DVD/CD master

Encryption: none

Cancel Save

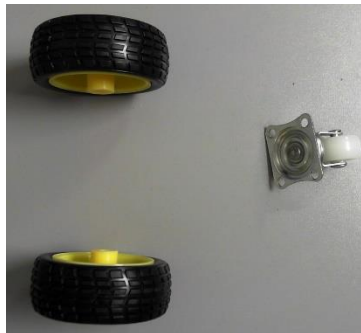
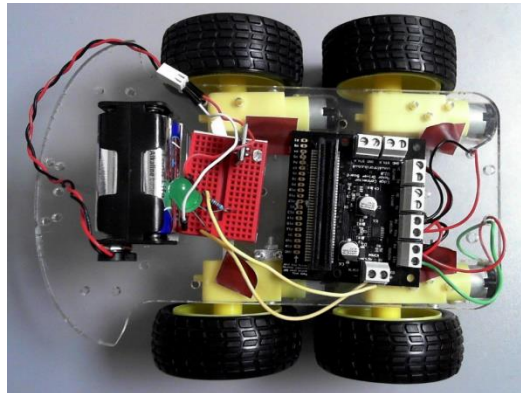
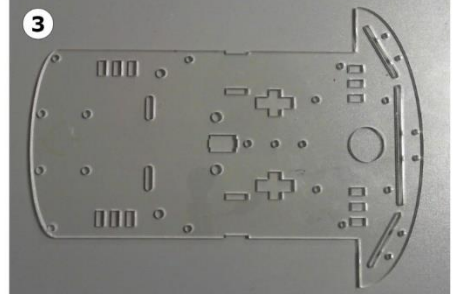
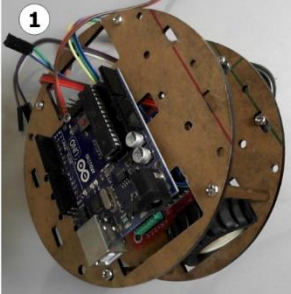


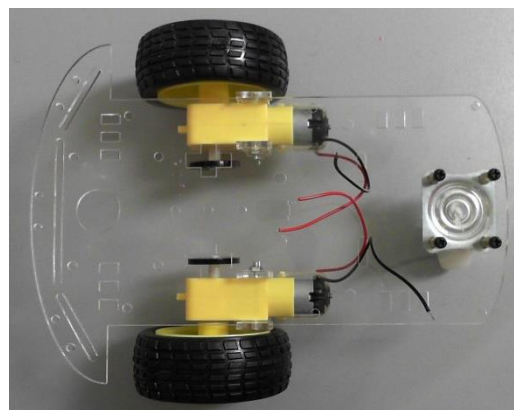
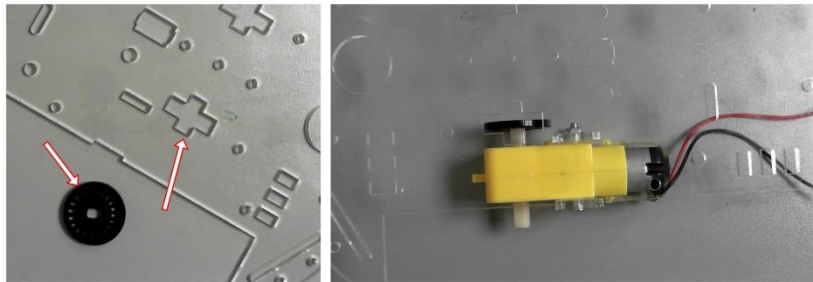
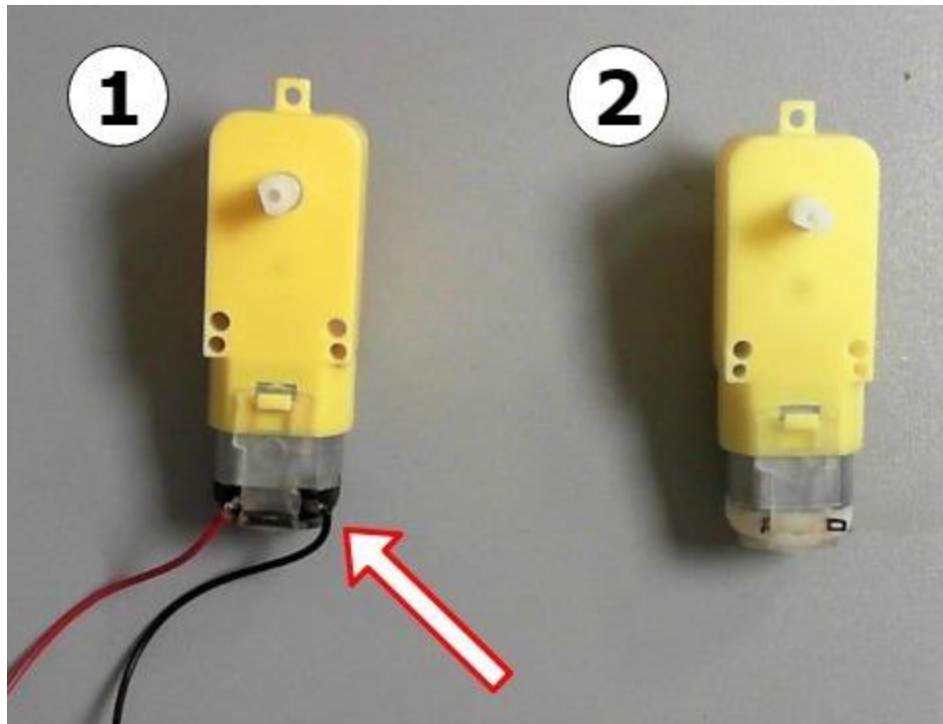
 **Are you sure you want to change the extension from ".cdr" to ".iso"?**

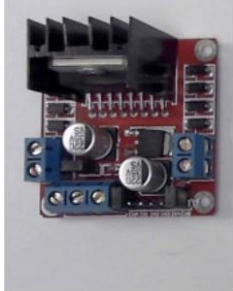
If you make this change, your document may open in a different application.

Keep .cdr Use .iso

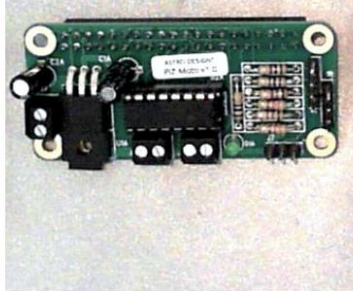
Chapter 6: Building Robot Basics – Wheels, Power, and Wiring



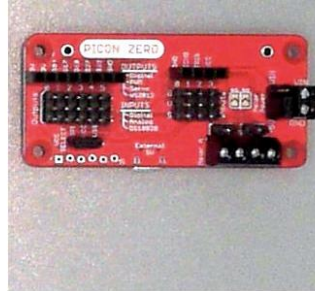




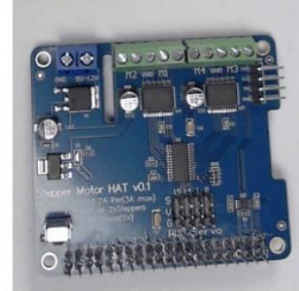
An L298N



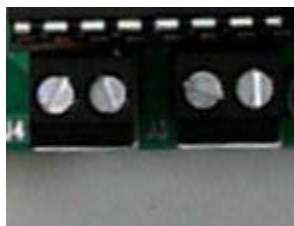
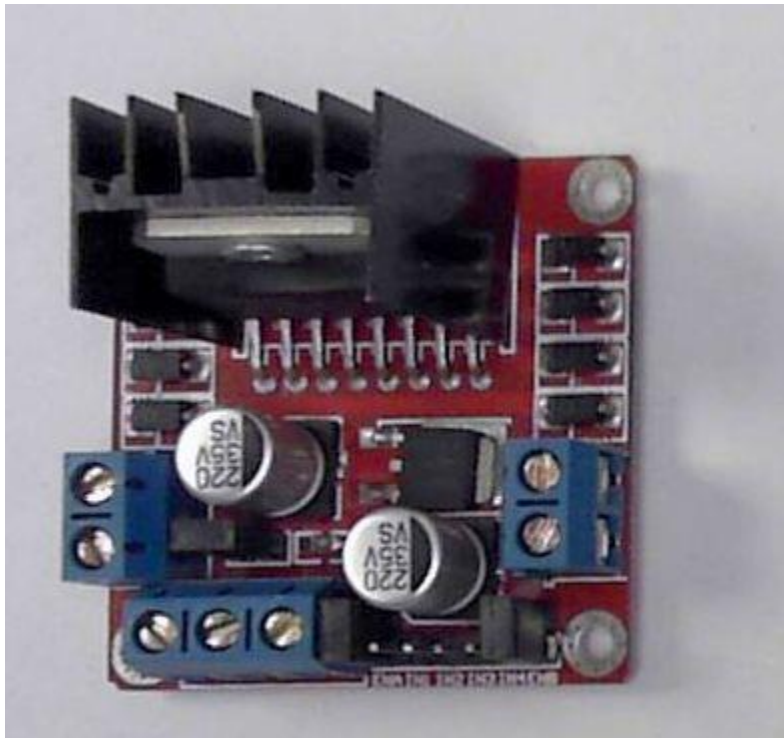
PiZ Moto

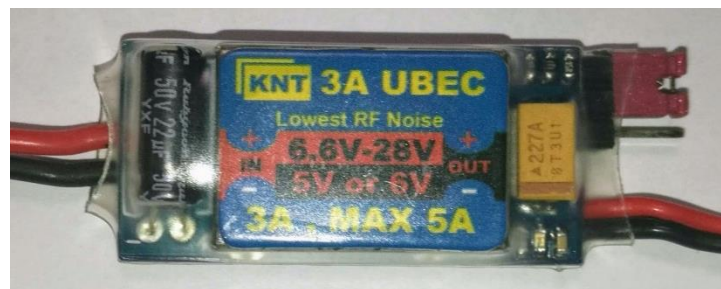
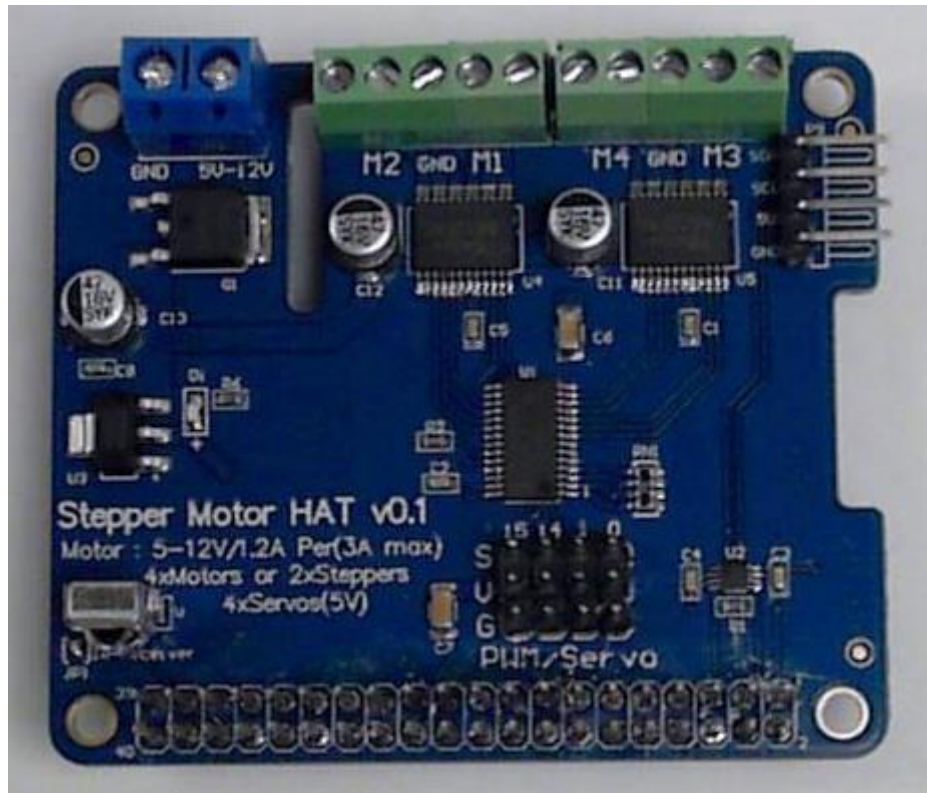


PiCon Zero



Full Function
Stepper Hat







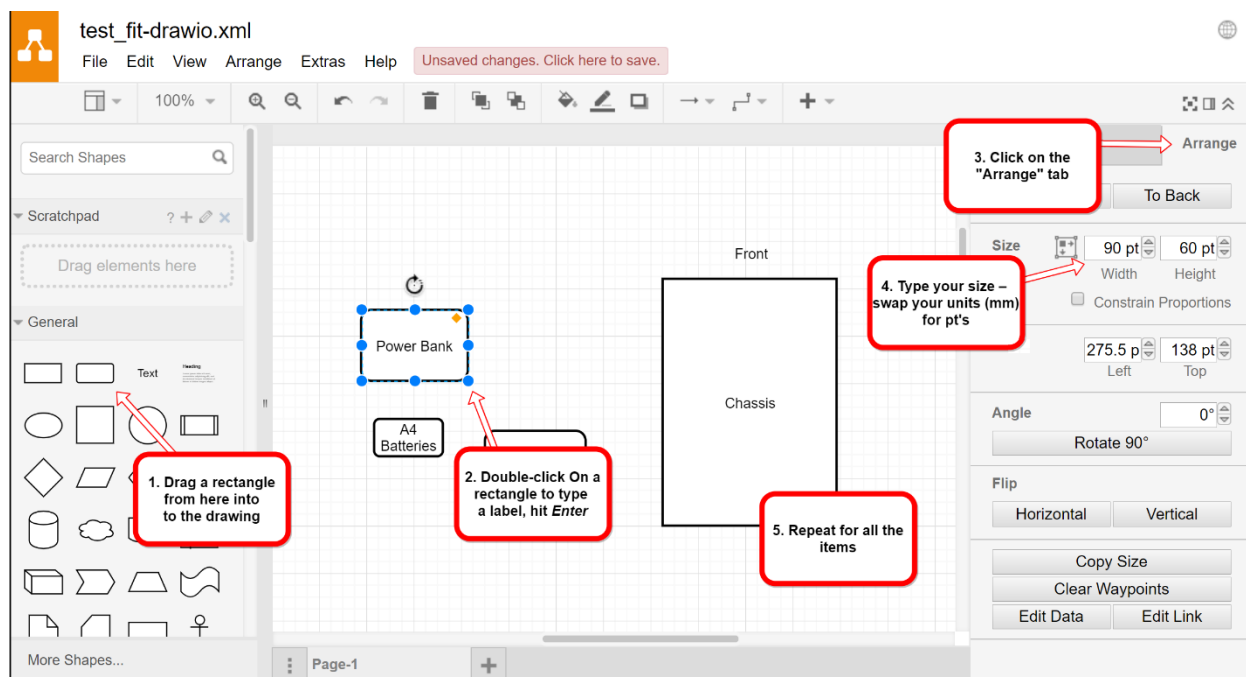
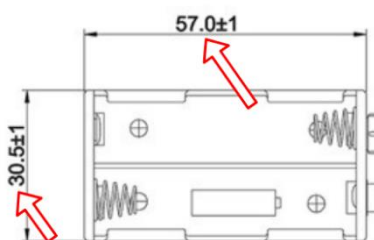
Product details

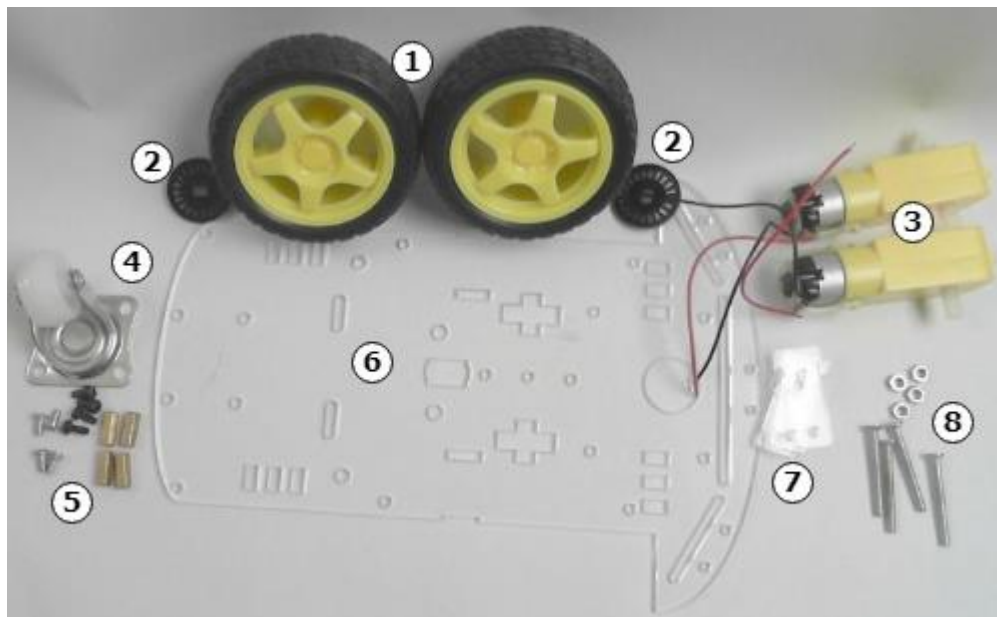
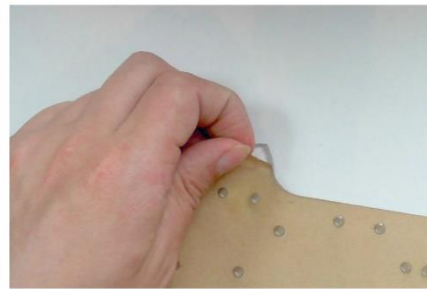
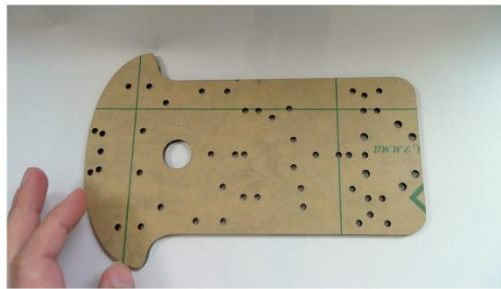
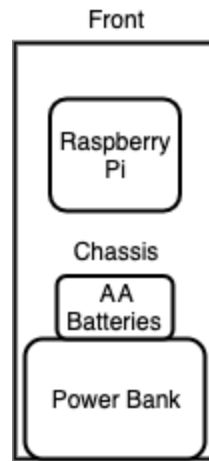
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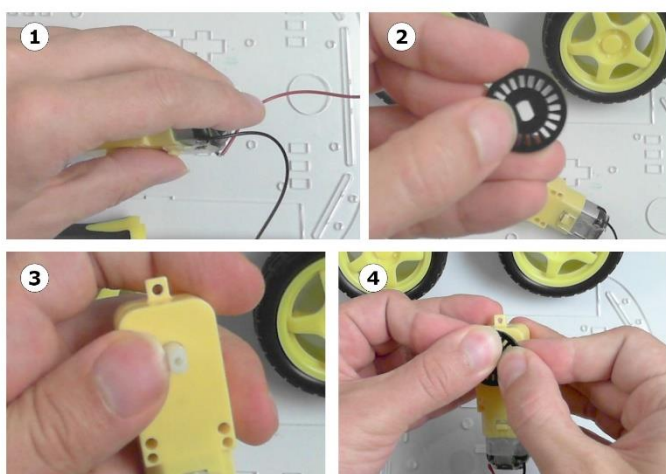
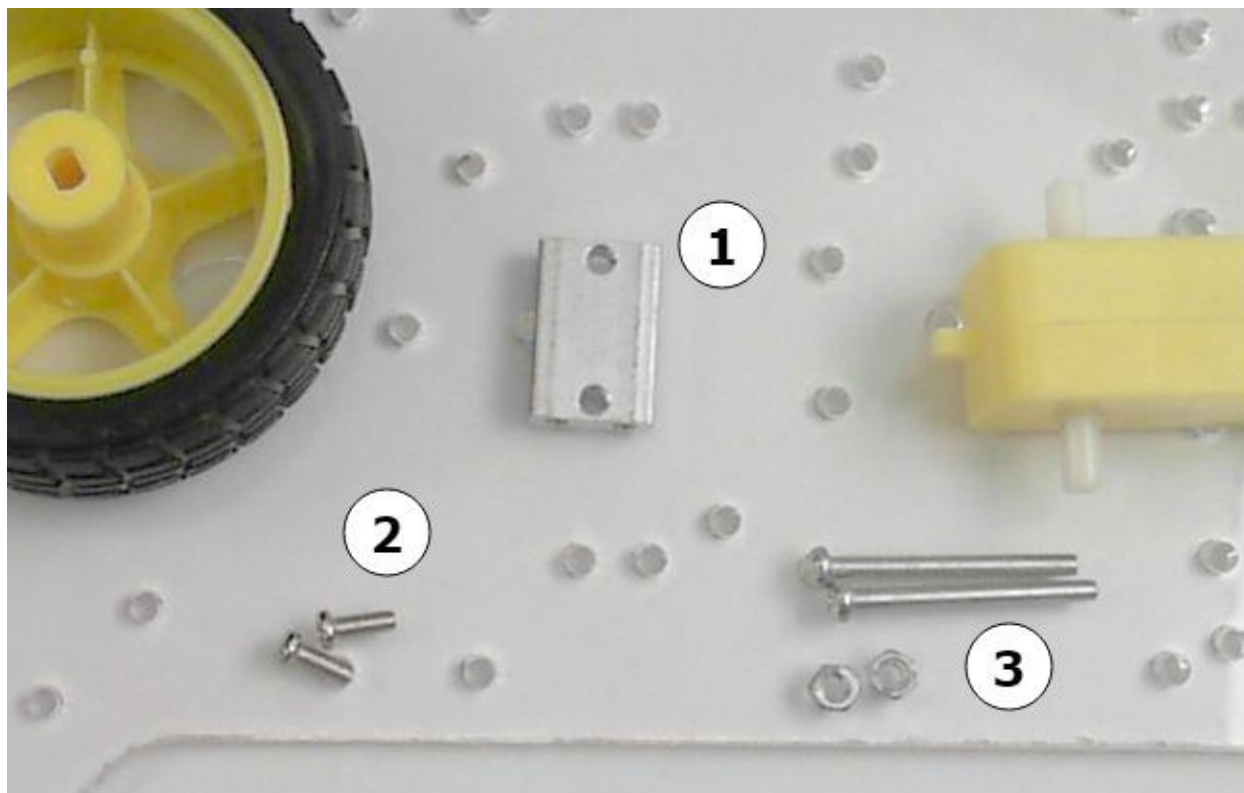
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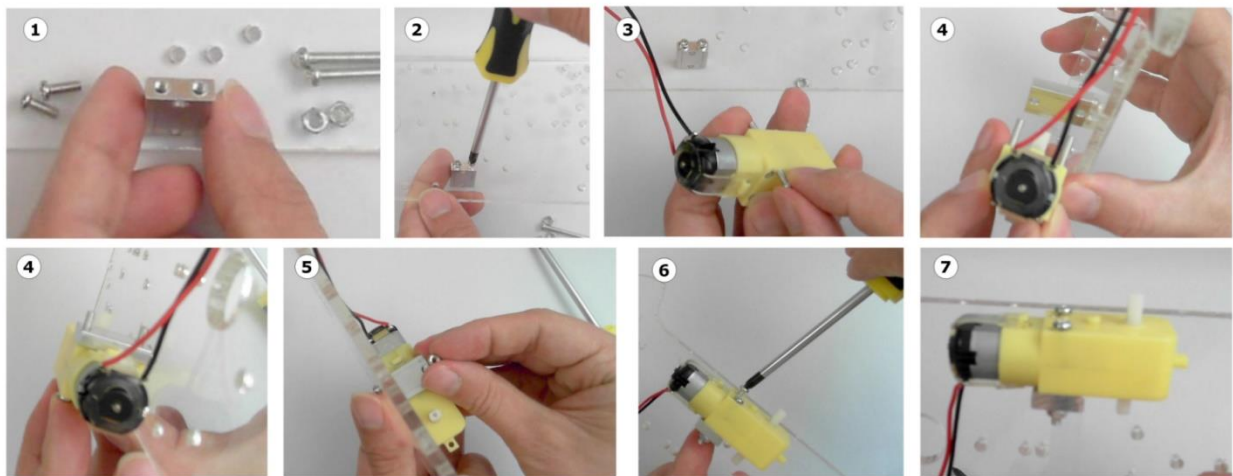
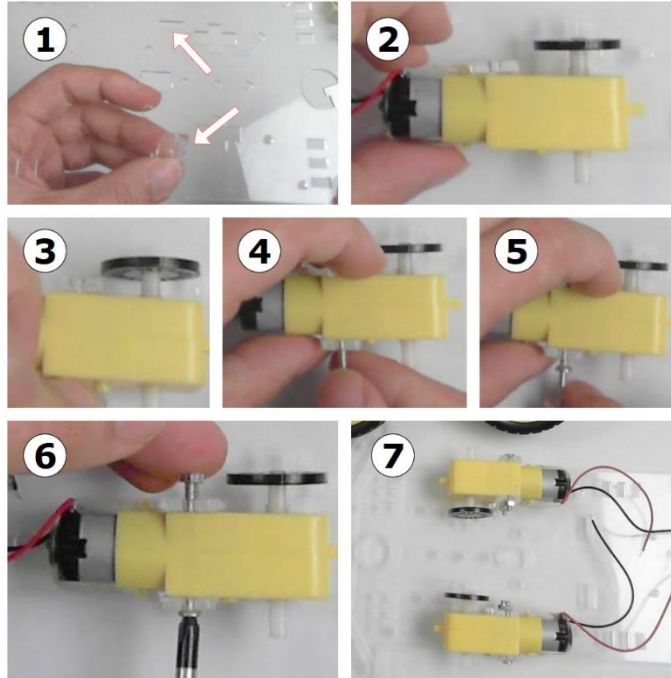
Boxed-product Weight: 281 g

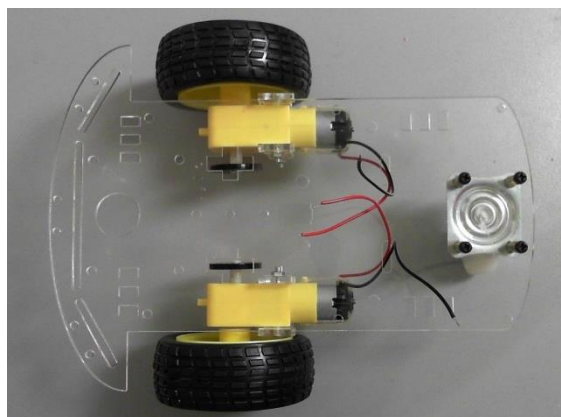
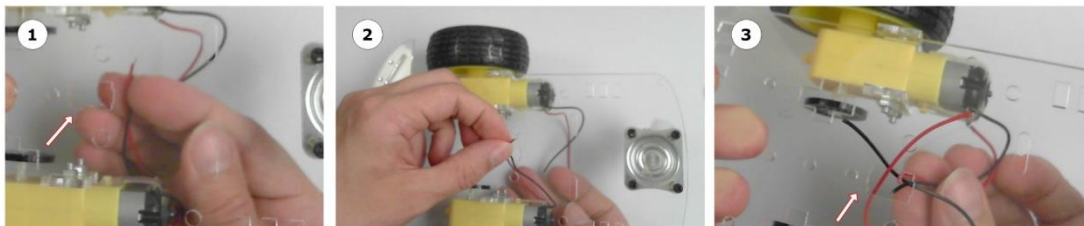
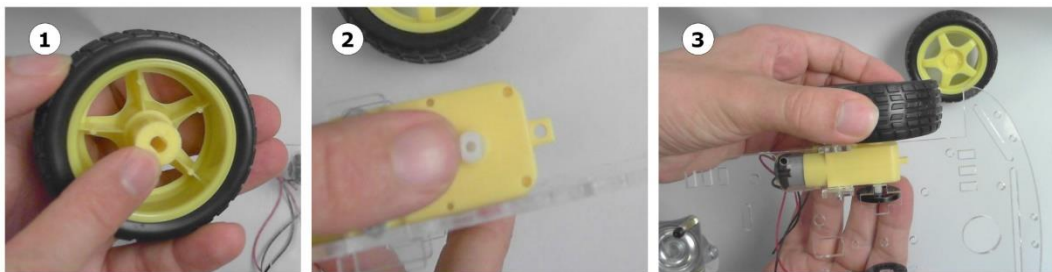
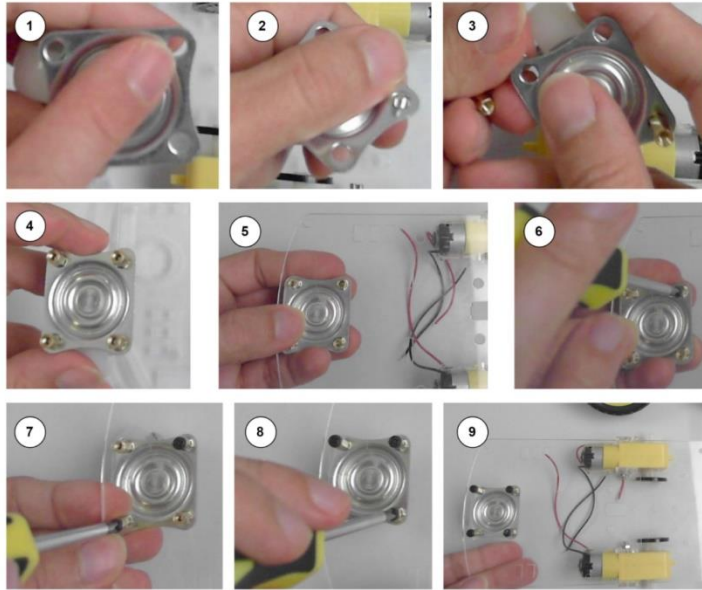
Delivery information: We cannot deliver certain products outside mainland UK

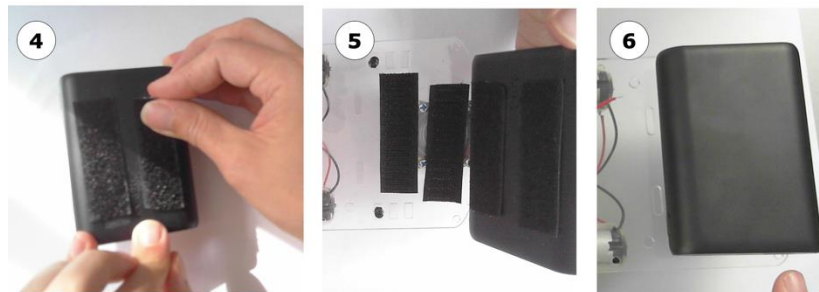
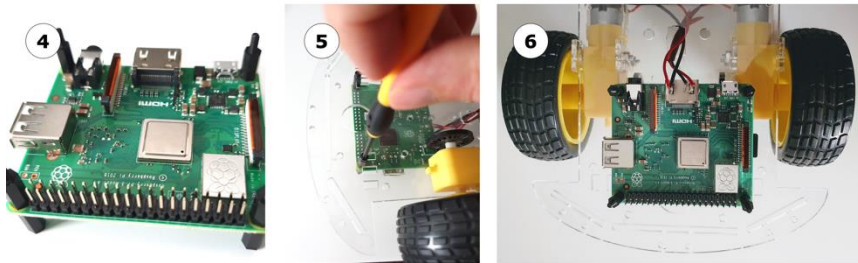
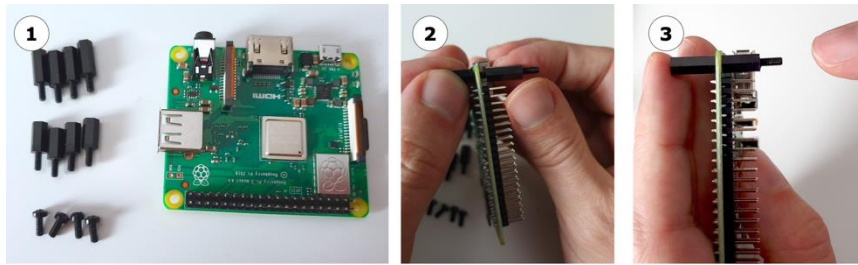


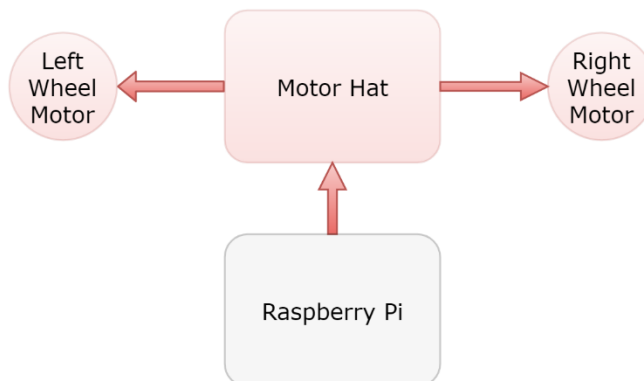
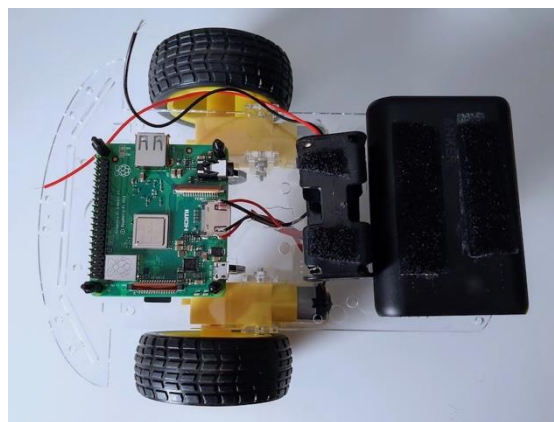
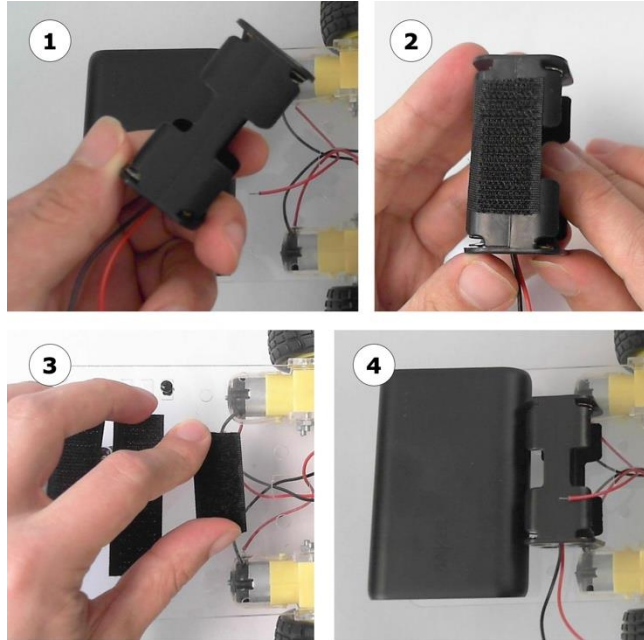


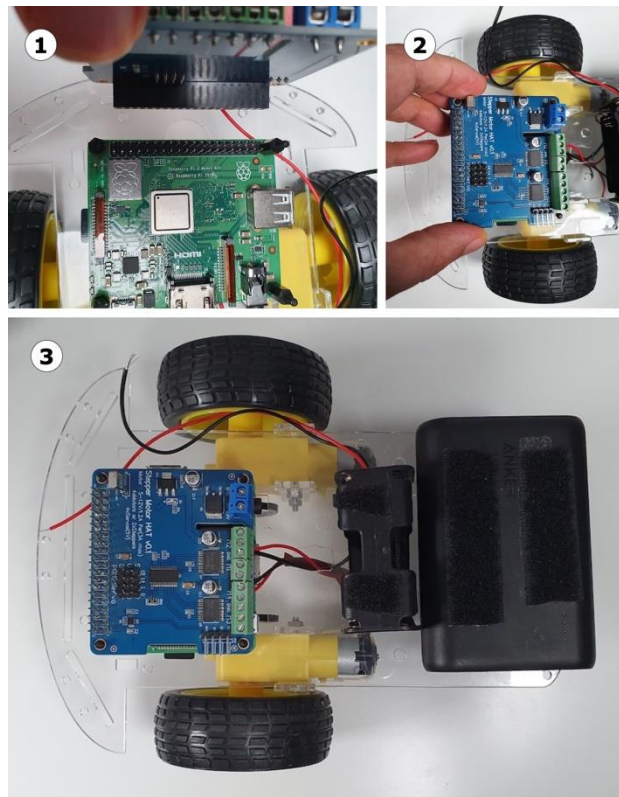
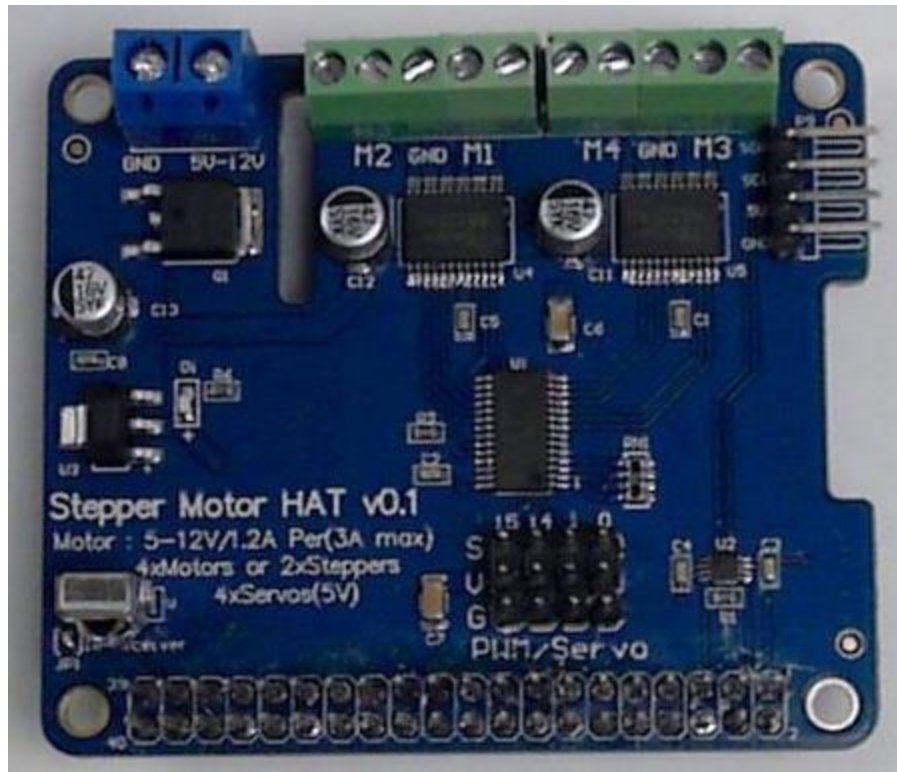


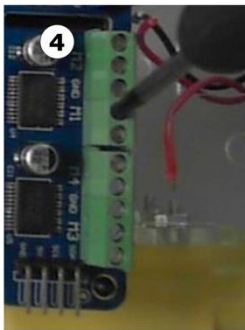
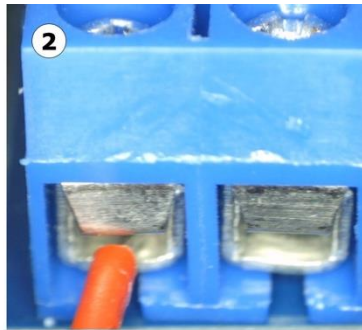
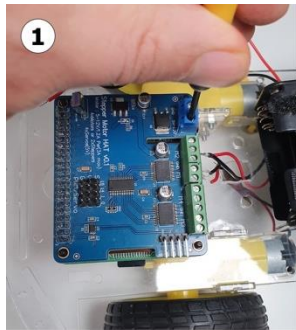
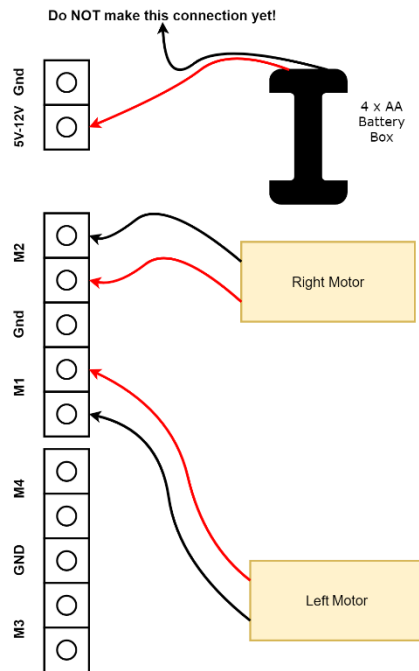


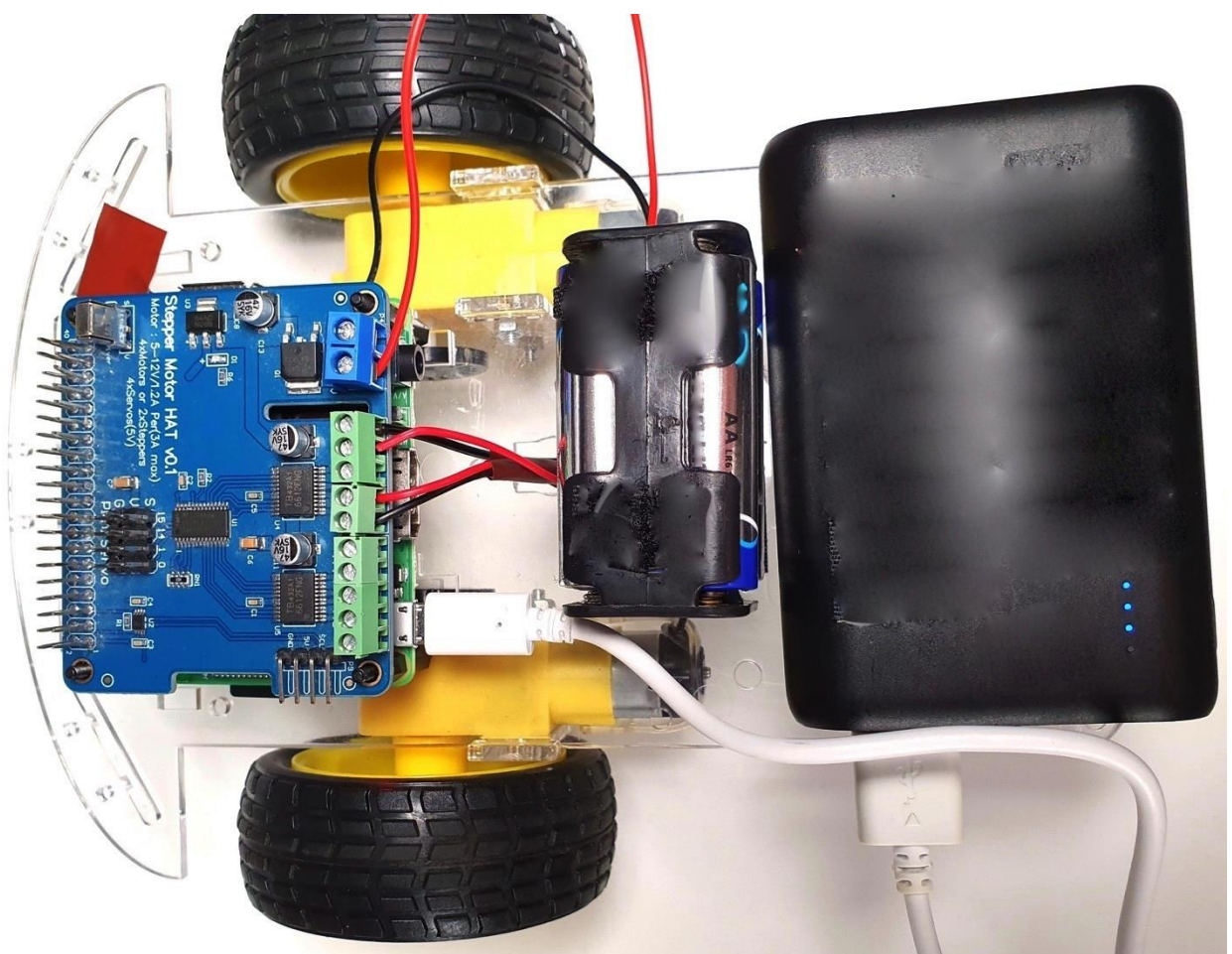
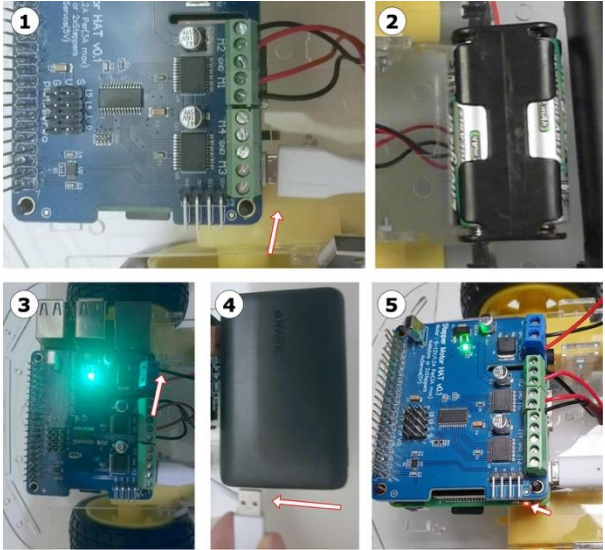




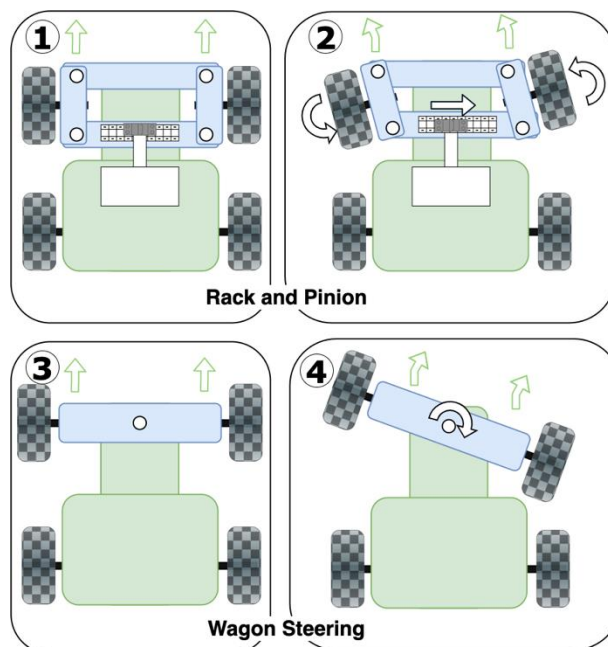
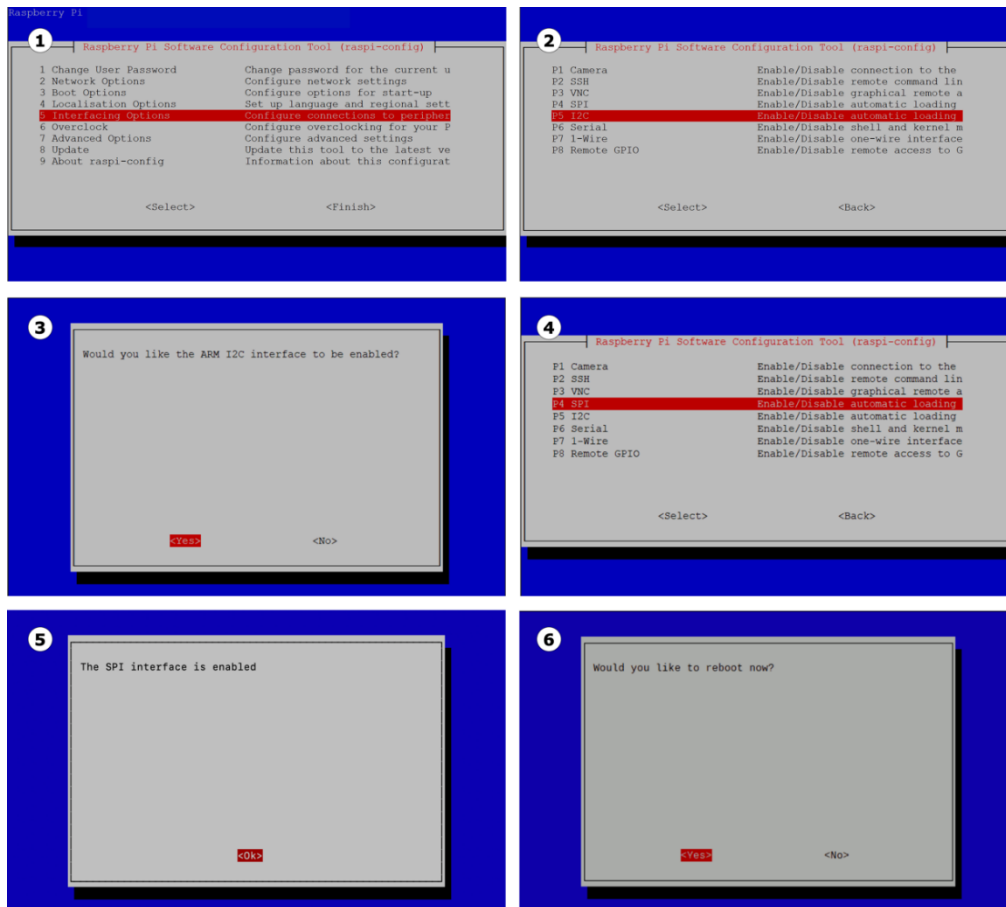


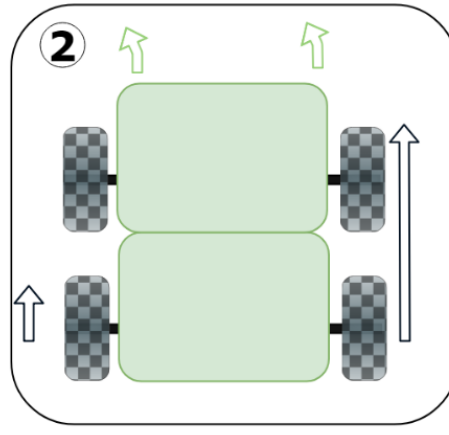
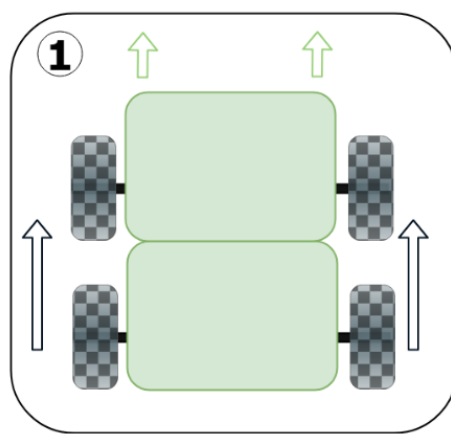
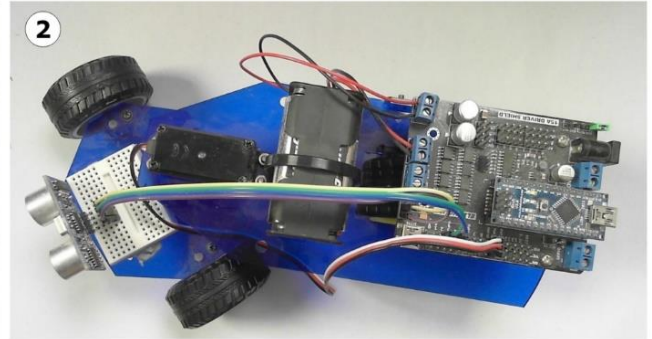
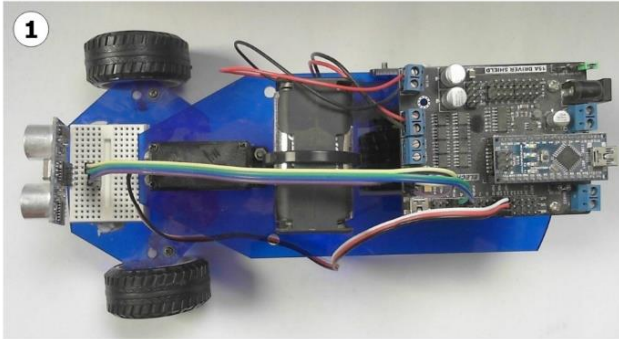






Chapter 7: Drive and Turn – Moving Motors with Python





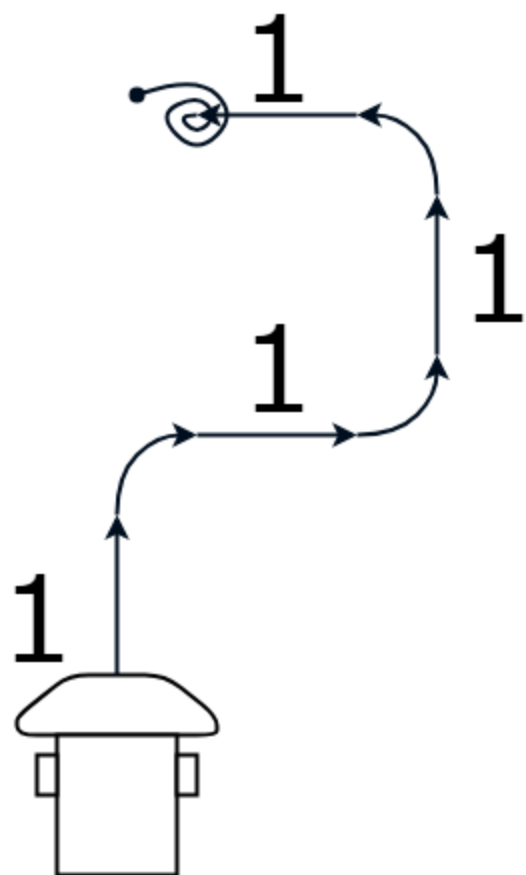


①

Path-following
behavior mixed
with setup and
motor control

②

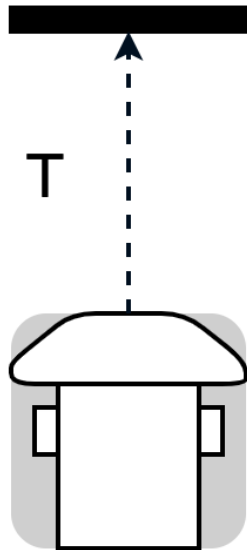
Path-following
behavior
↓
Robot hardware
setup and control



Chapter 8: Programming Distance Sensors with Python

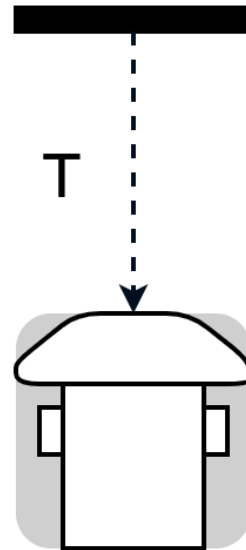
1. Pulse Fired - "Ping"

A pulse of light or sound is fired from the sensor.



2. Pulse Reflected - "Pong"

A pulse of light or sound is reflected.

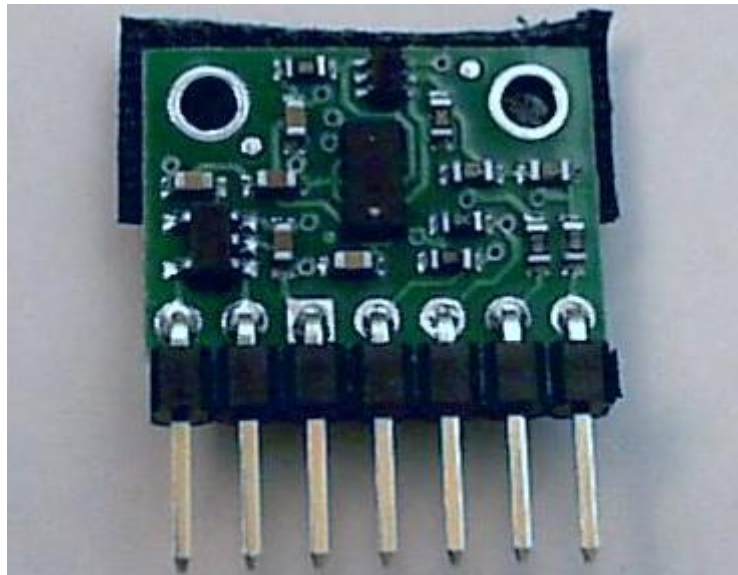


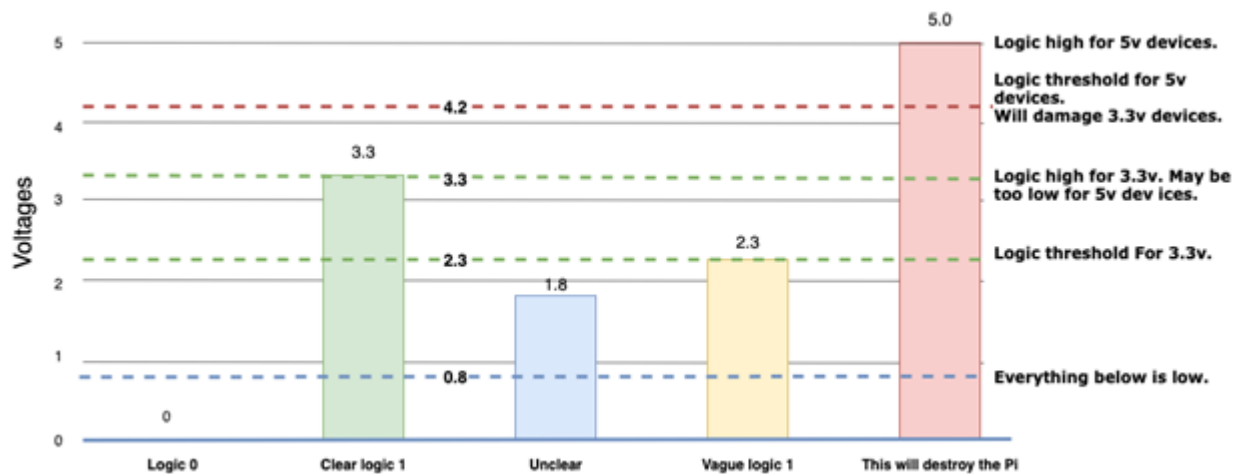
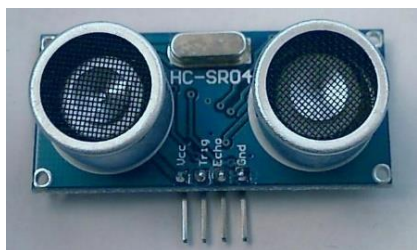
3. Time Calculated

The time for the pulse to go out and return will vary based on the distance.

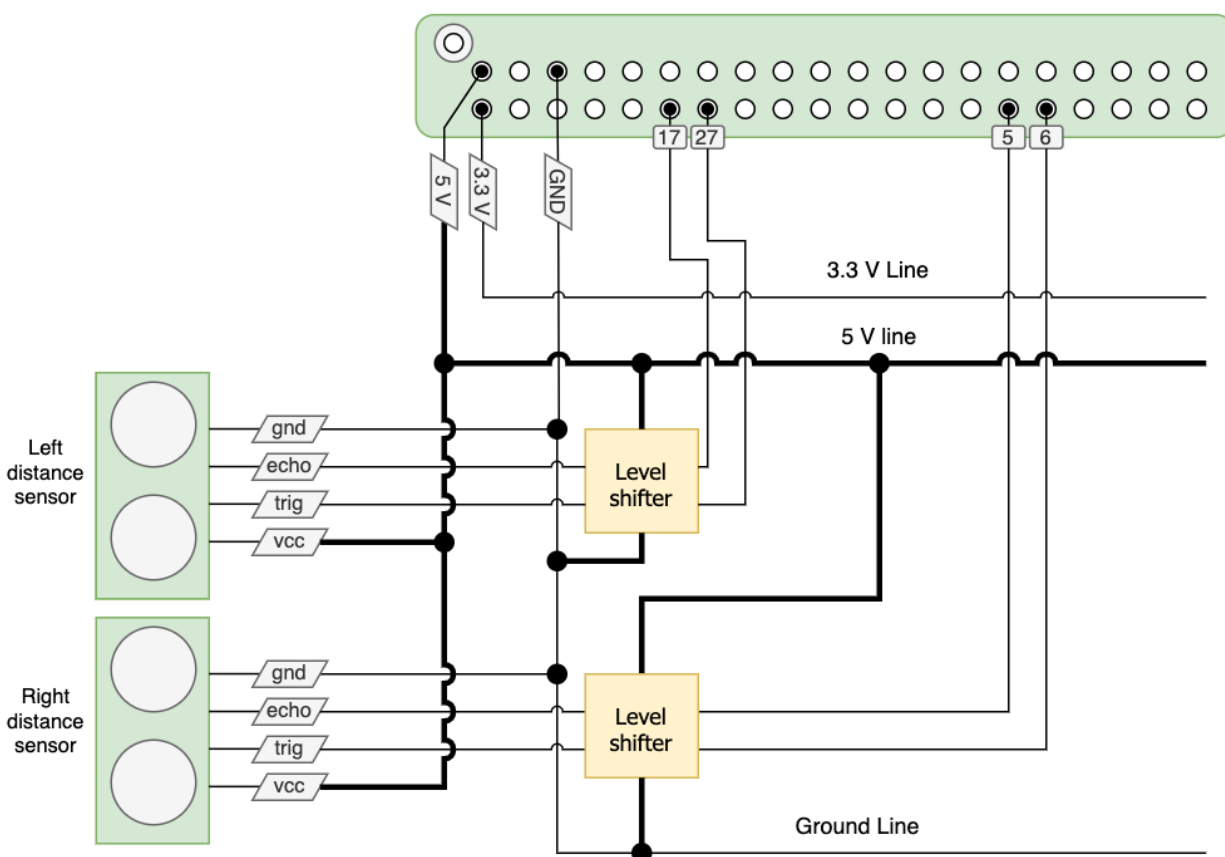
4. Distance Calculated

Using the speed of light, or sound with the return time, gives a distance.



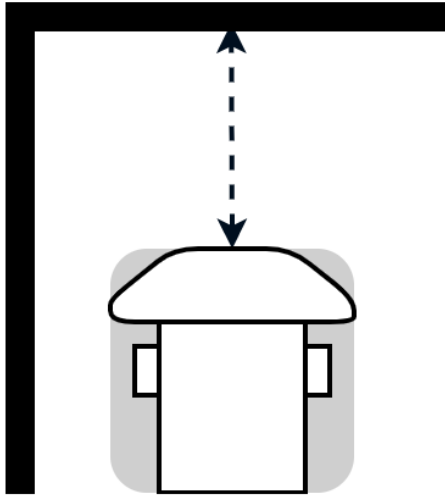


Raspberry Pi
GPIO



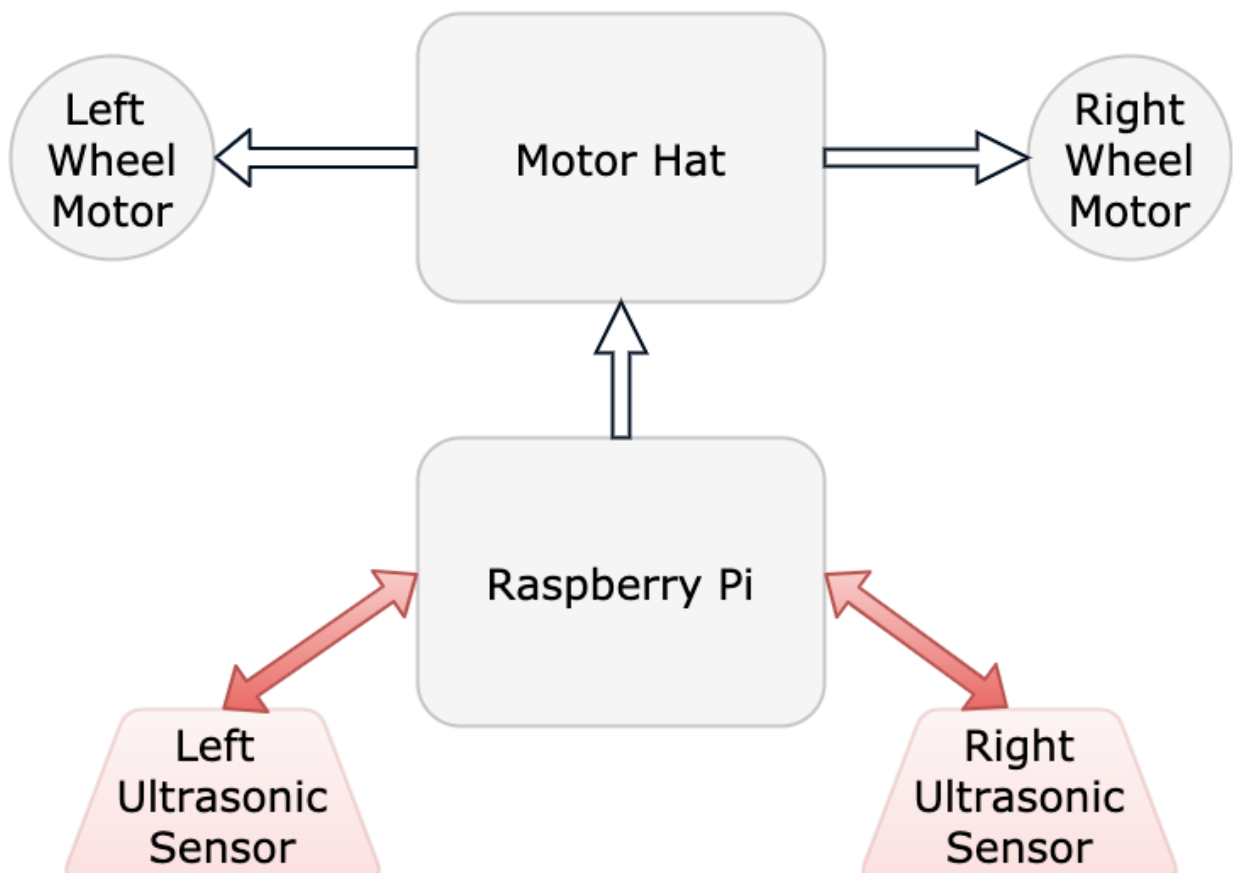
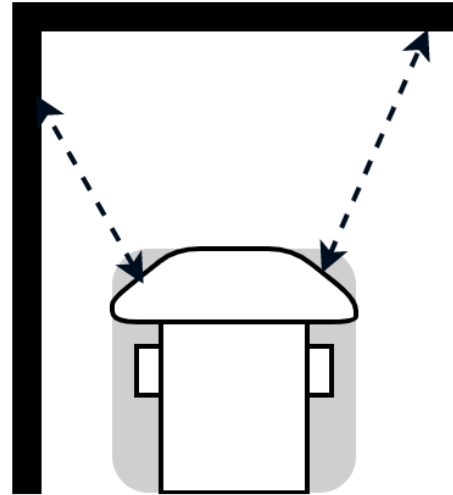
1. Forward Single Sensor

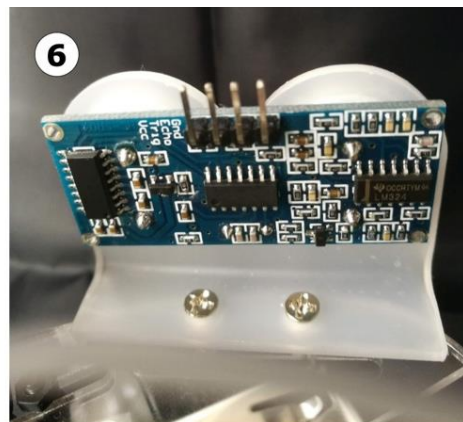
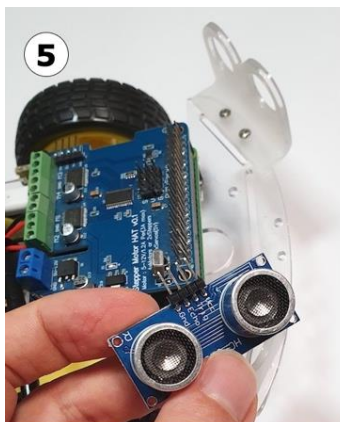
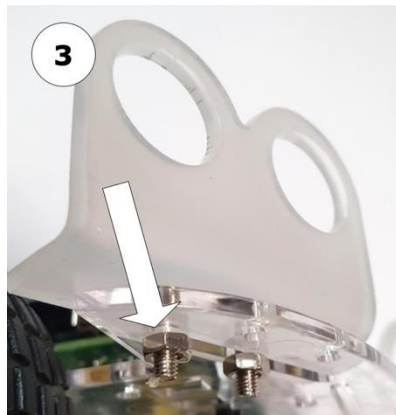
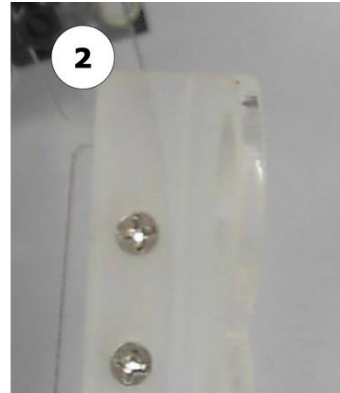
Robot can avoid the wall in front.

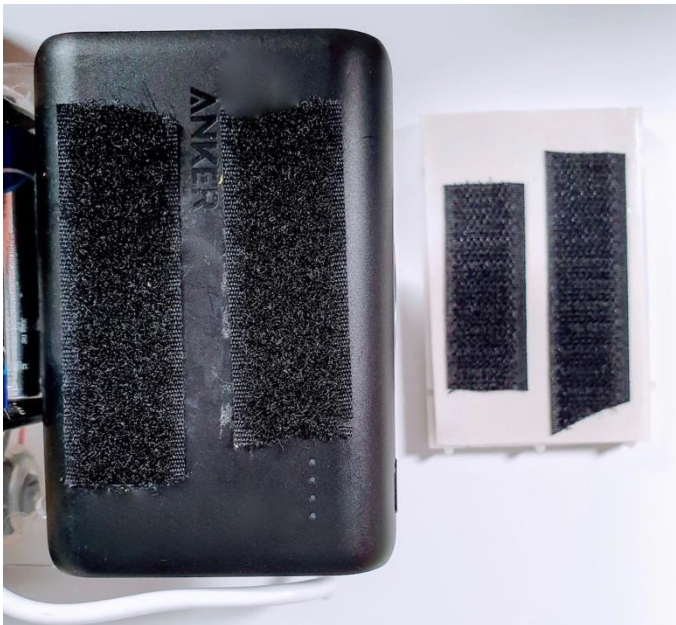
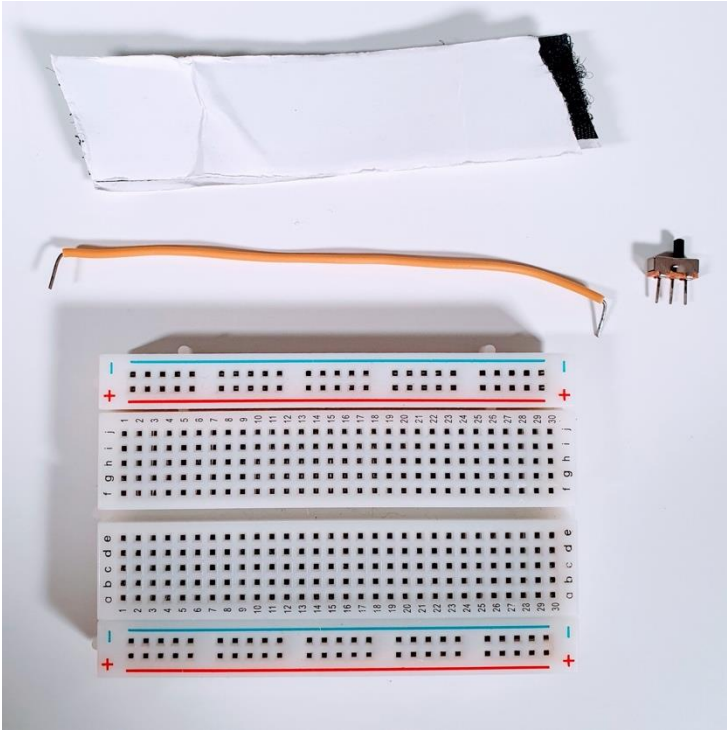


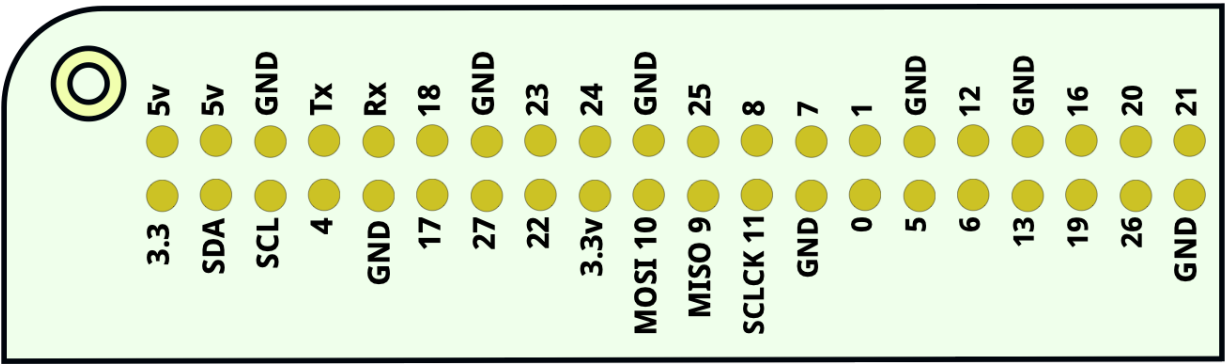
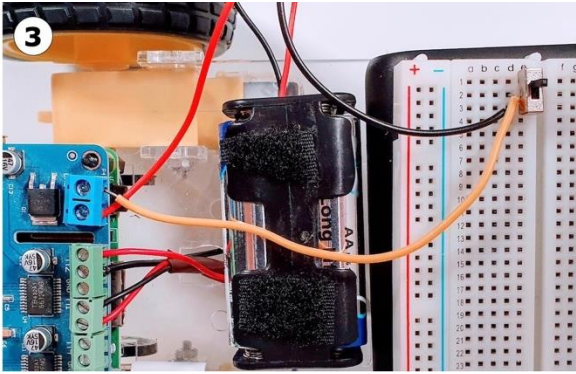
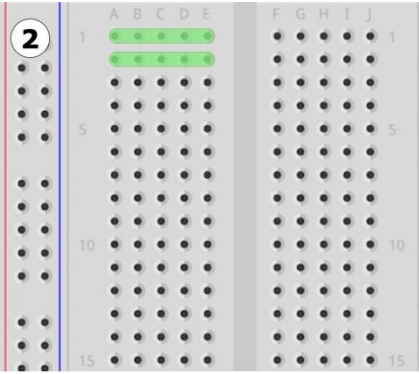
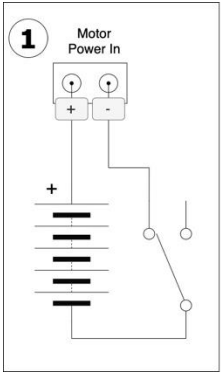
2. Two Sensors

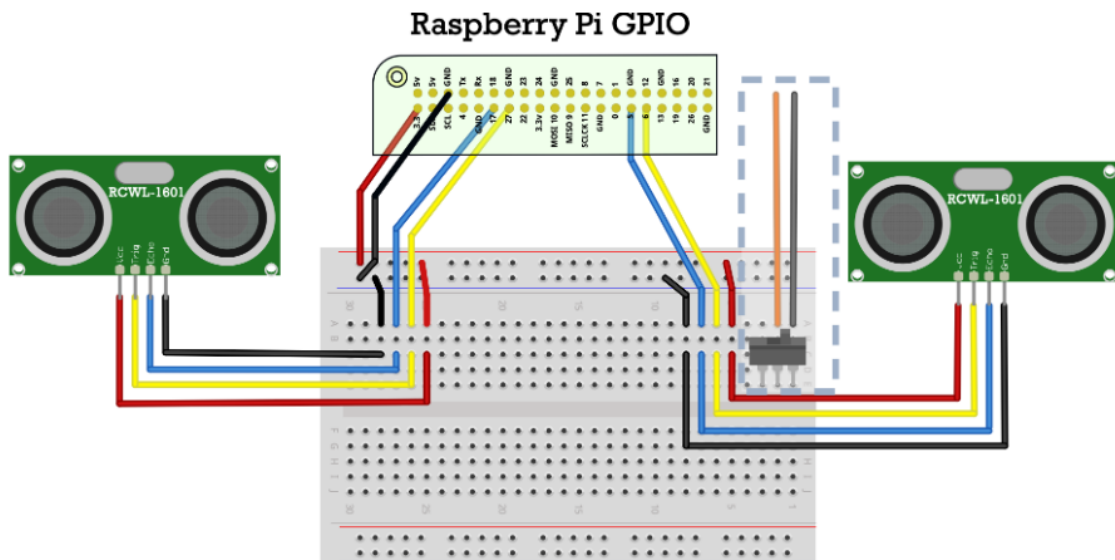
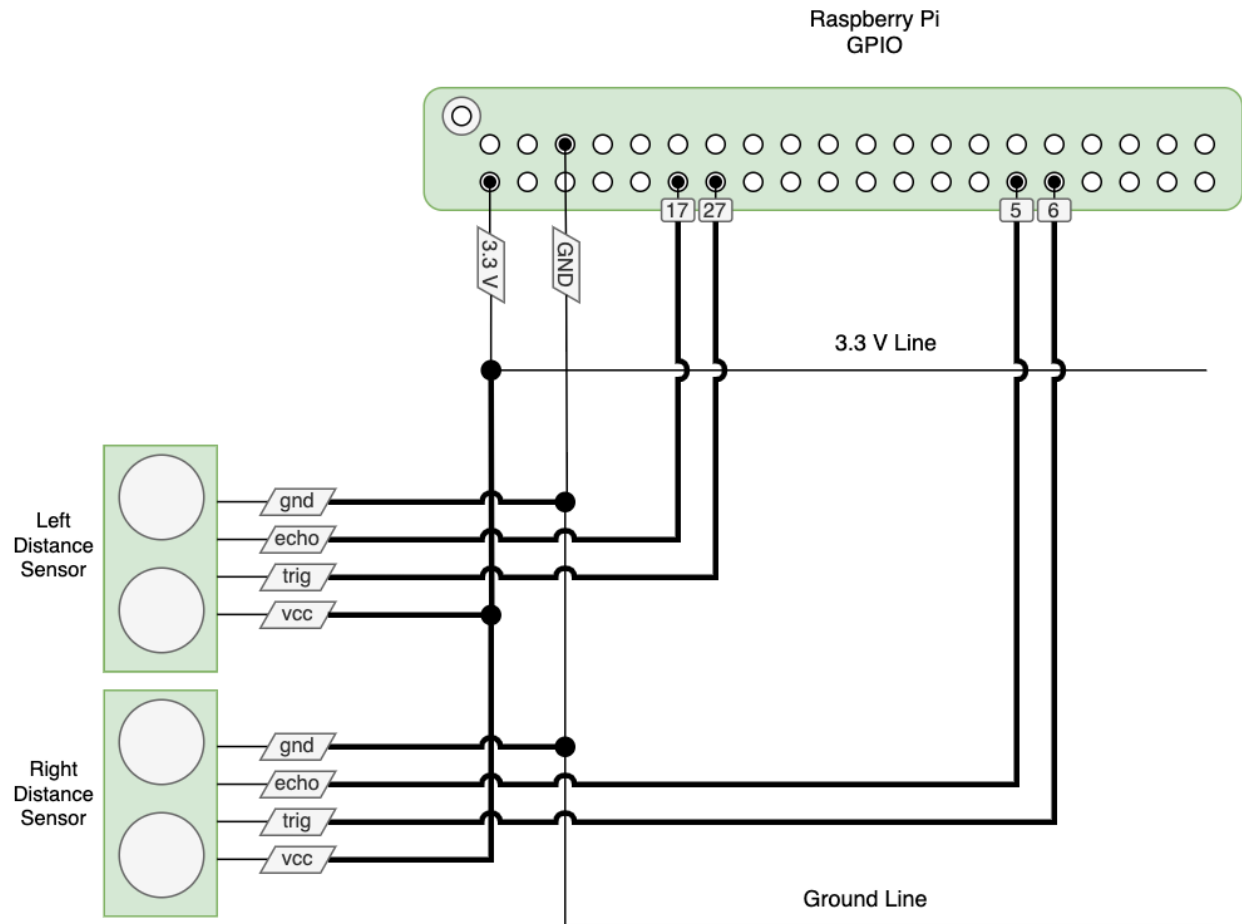
Robot can avoid front and left wall.

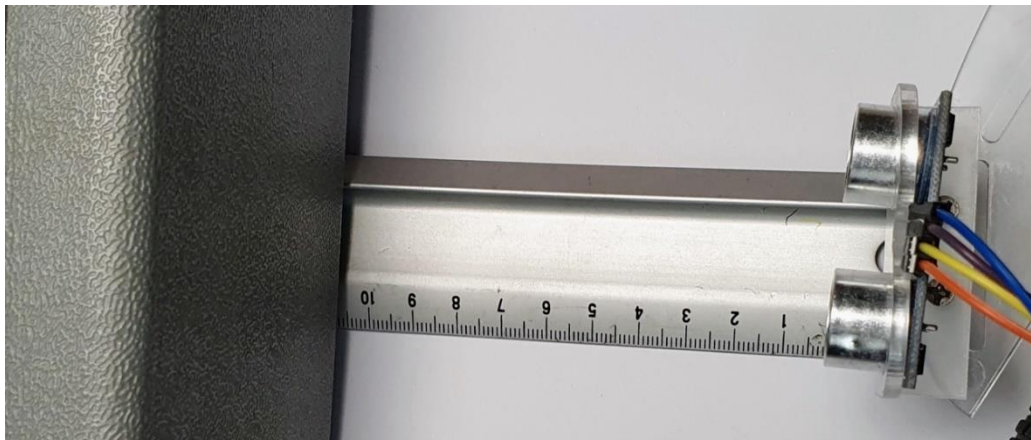
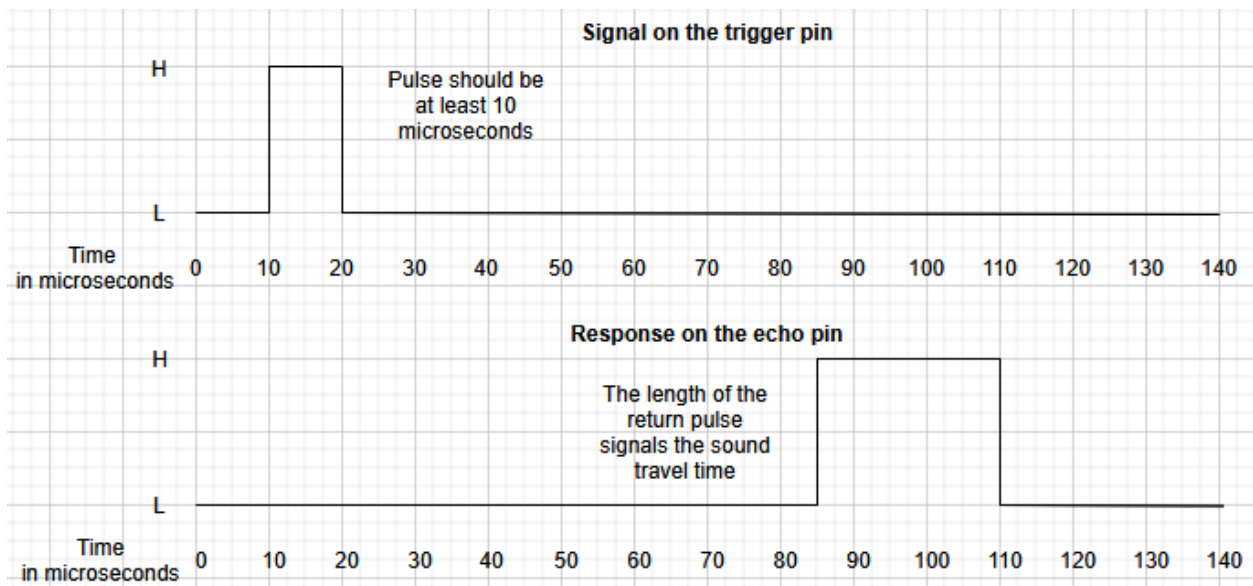




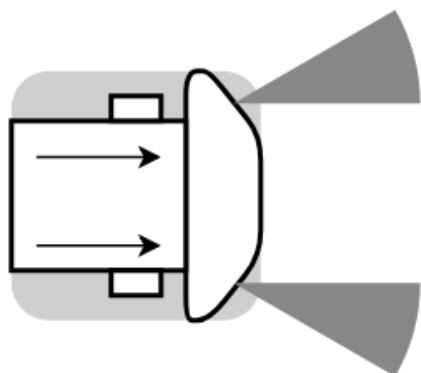




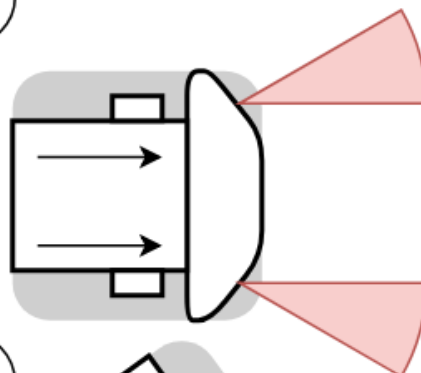




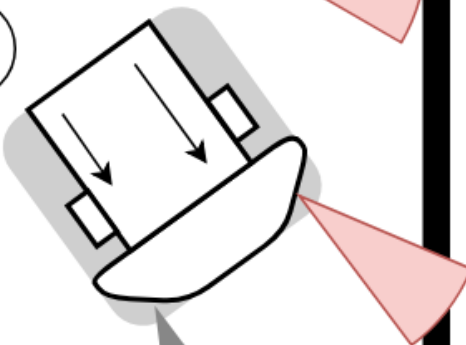
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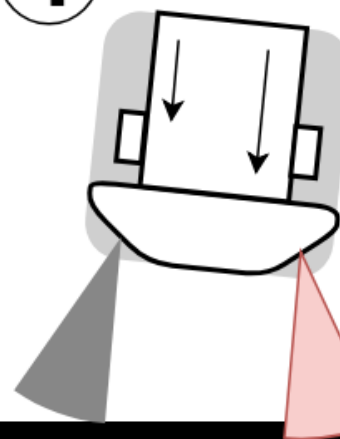
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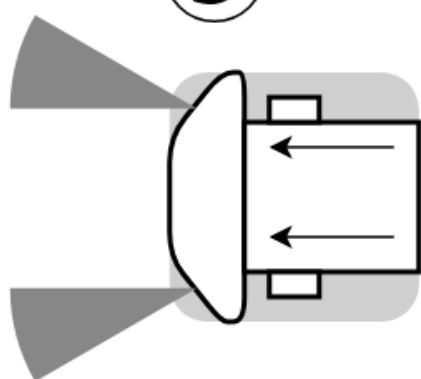
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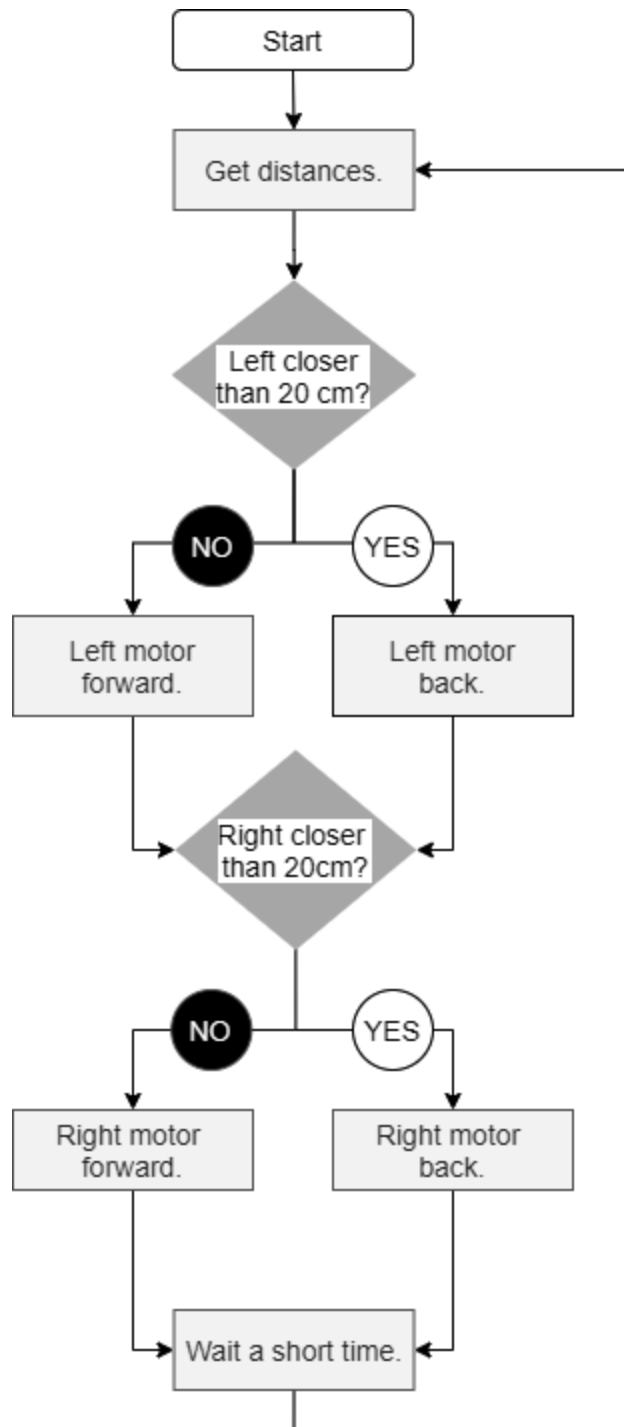


4

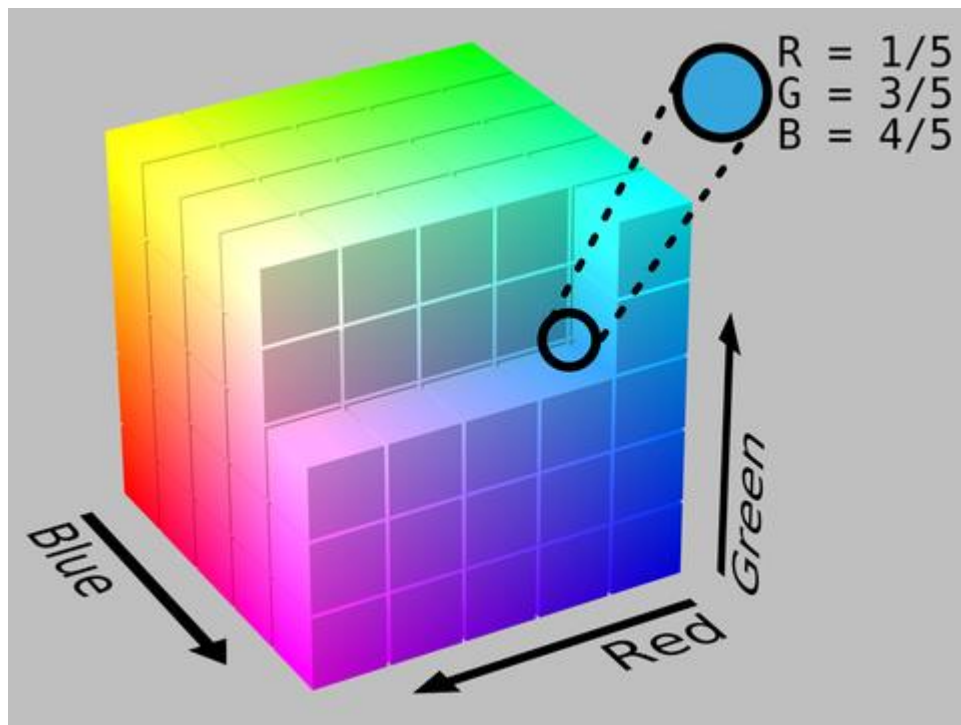
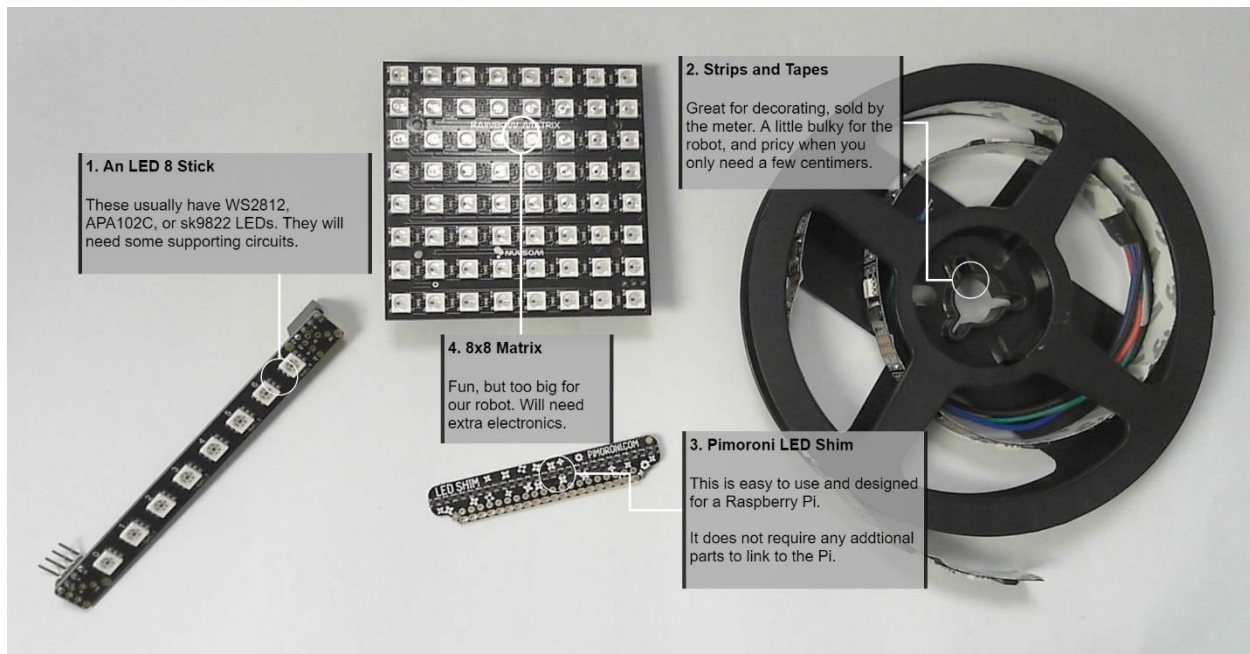


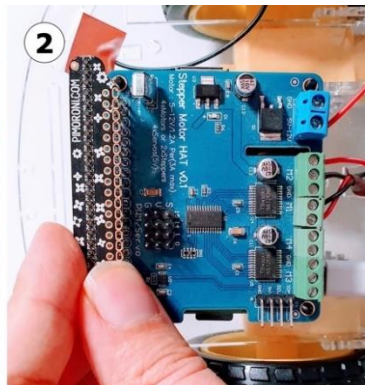
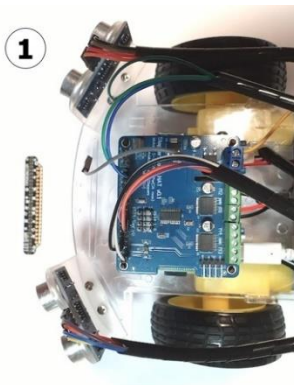
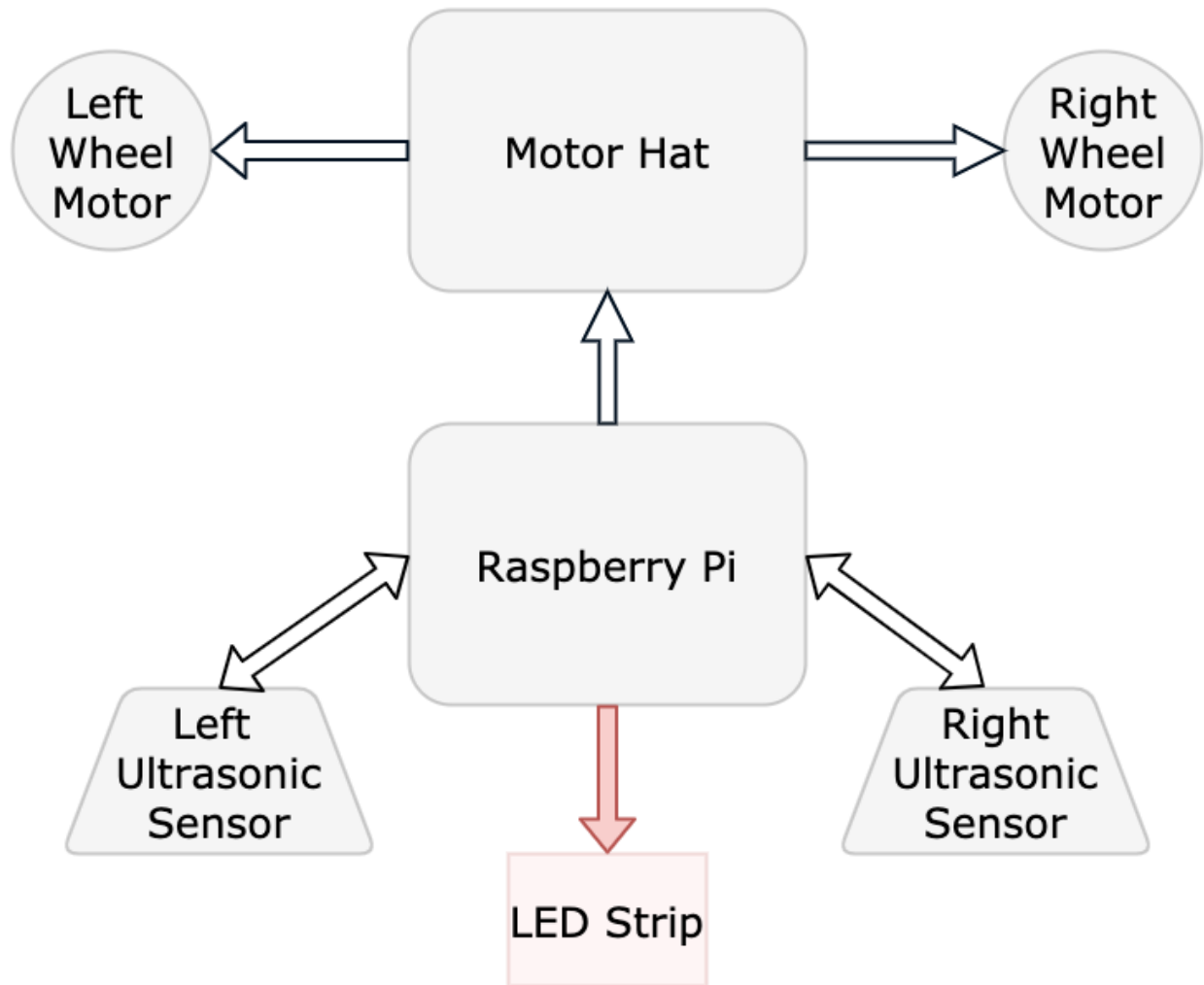
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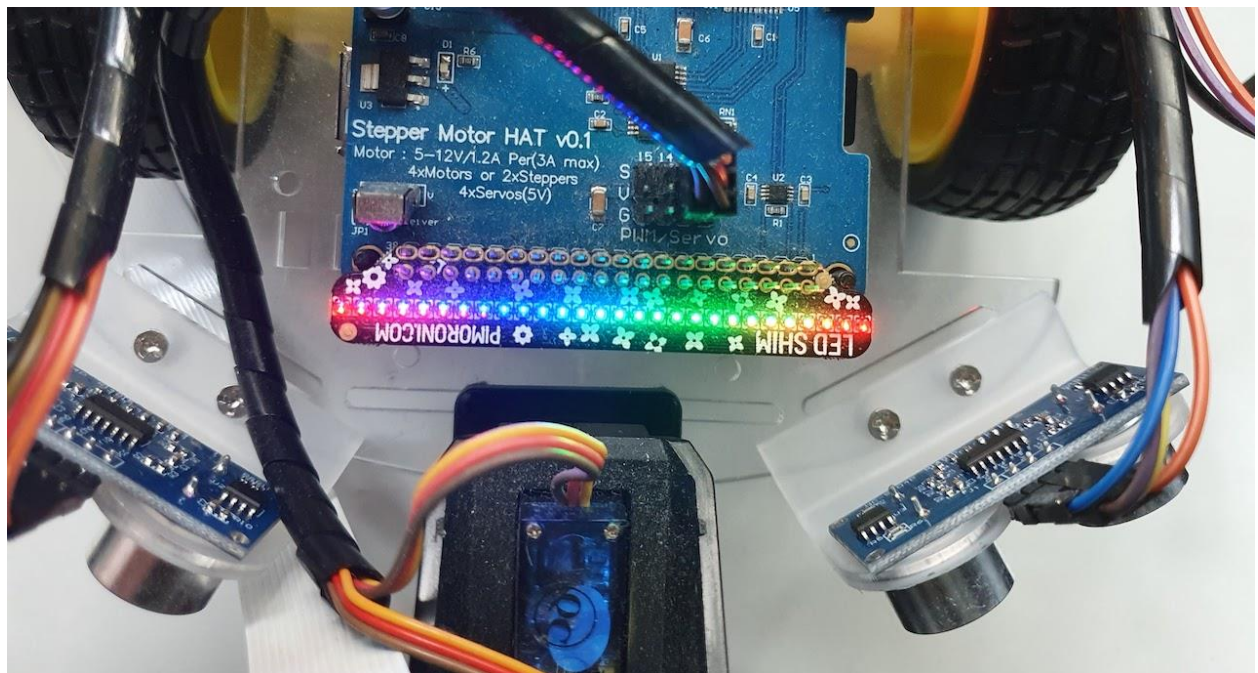


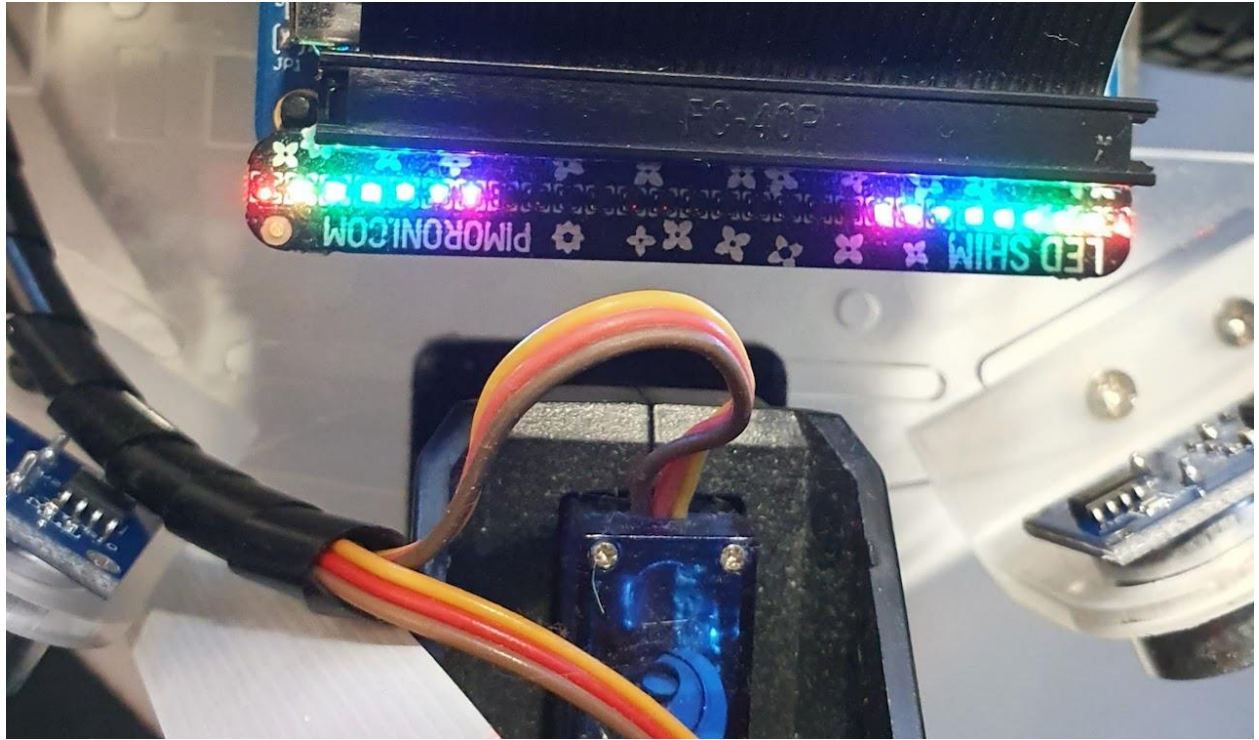


Chapter 9: Programming RGB Strips in Python

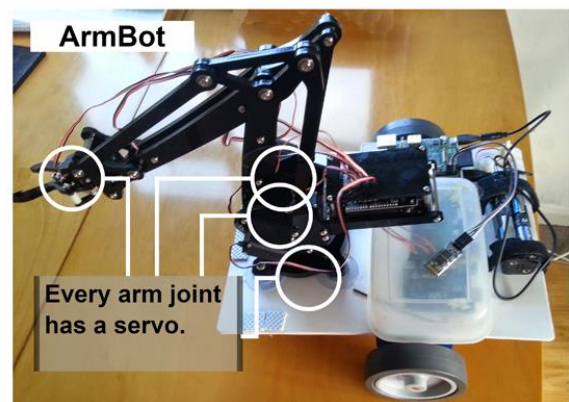
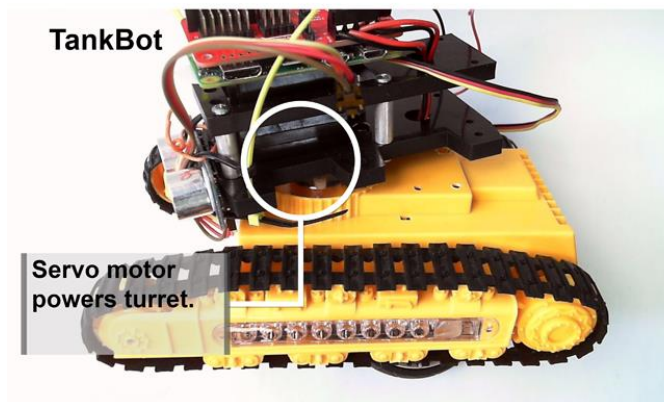
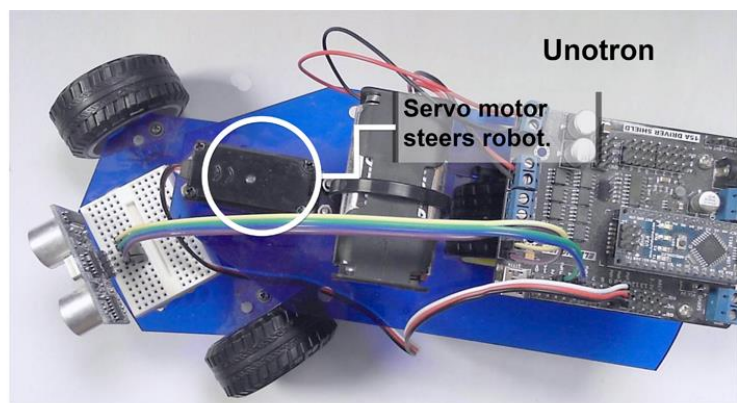
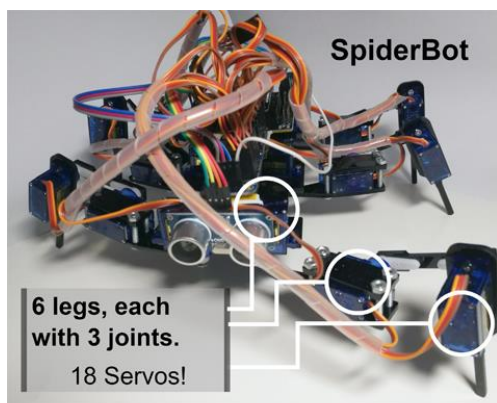
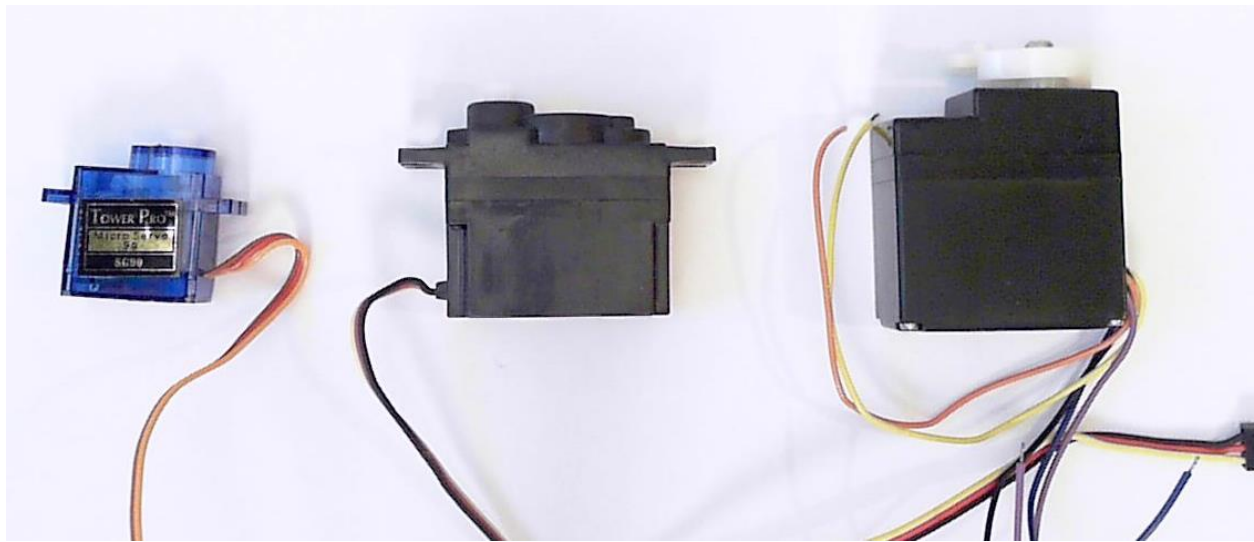


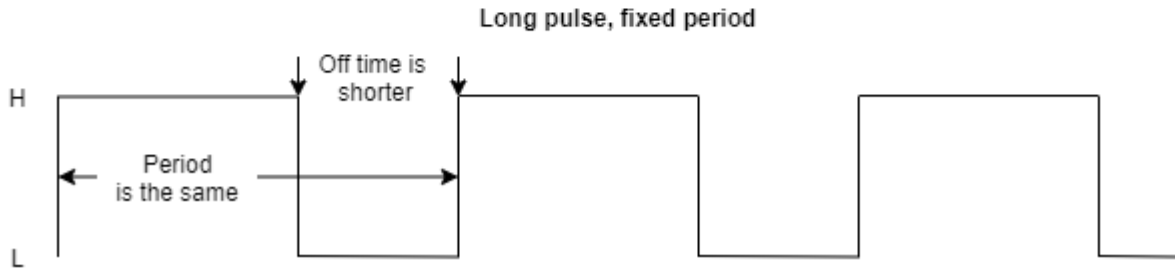
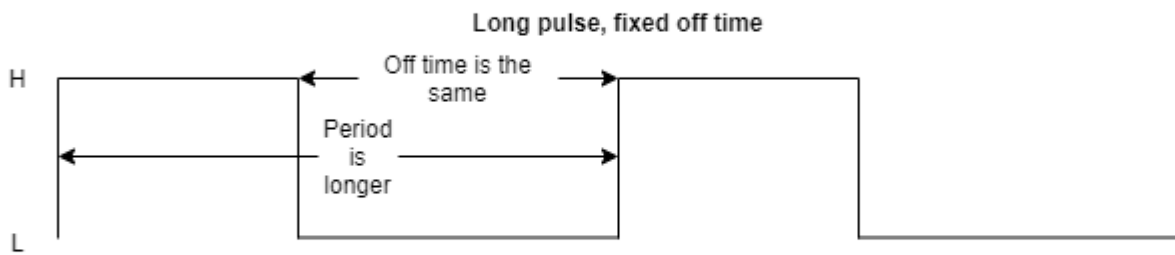
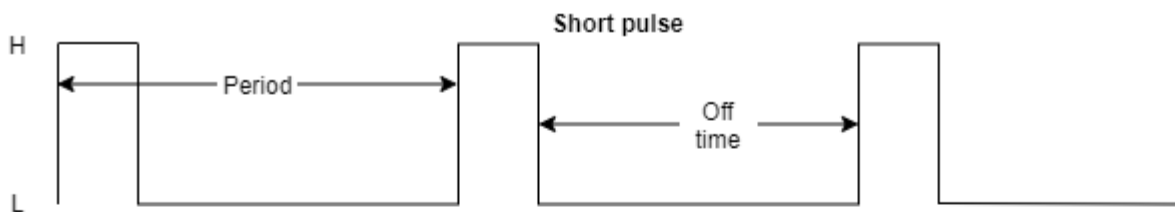
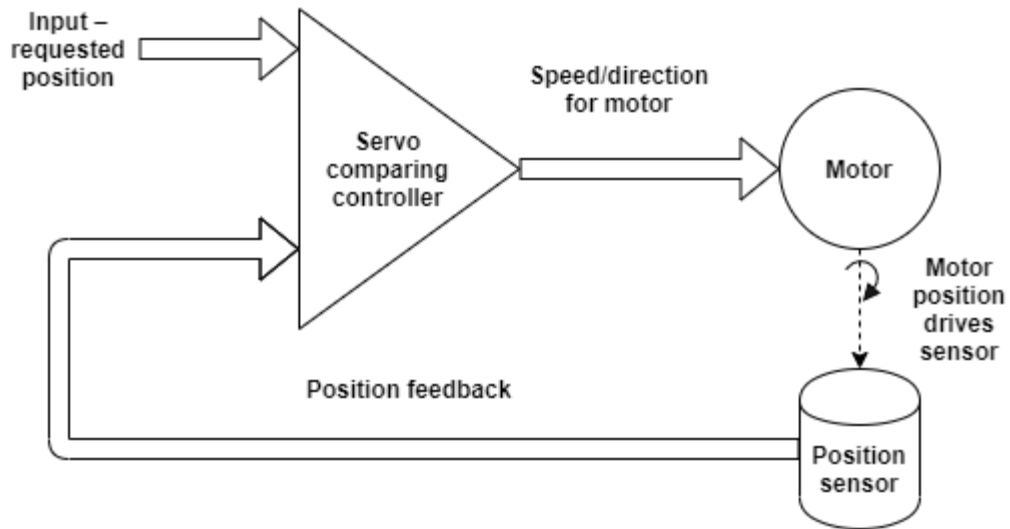


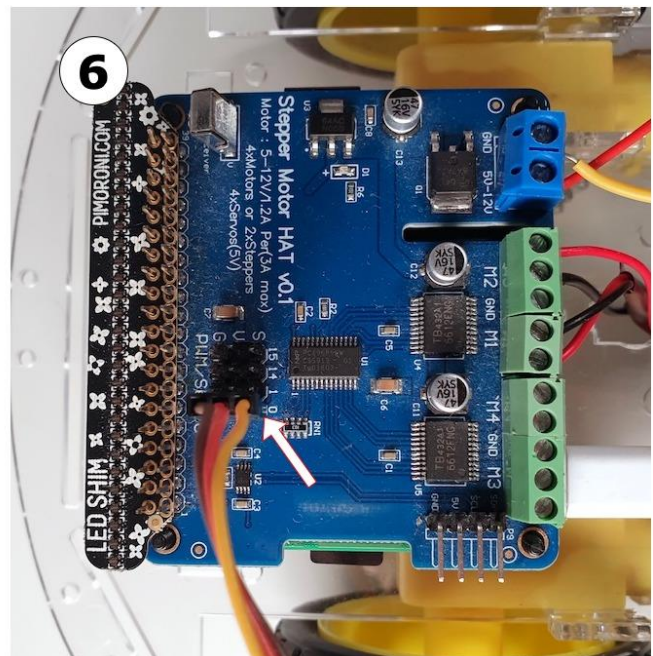
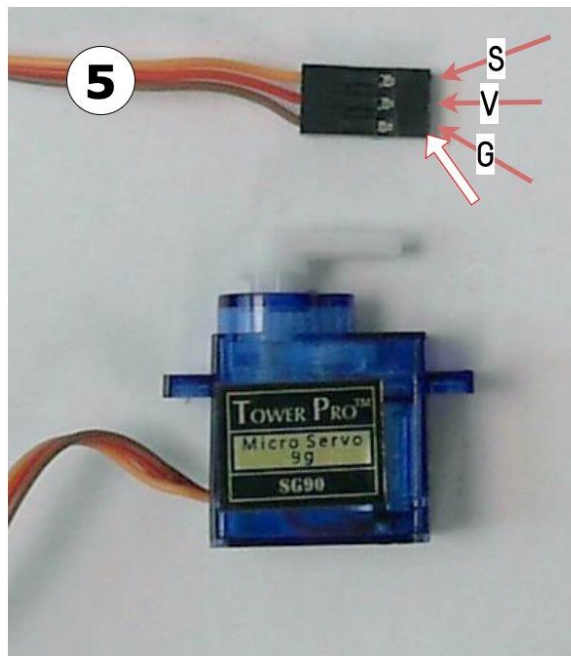
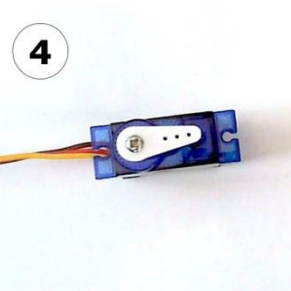
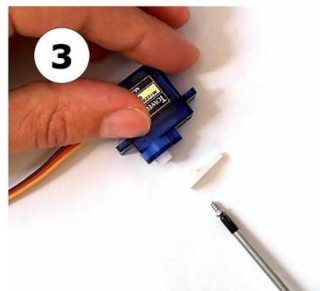
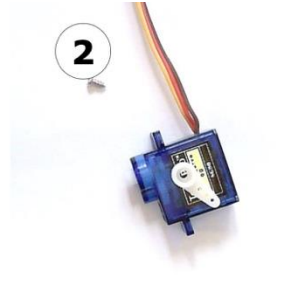
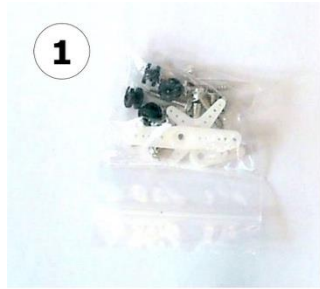


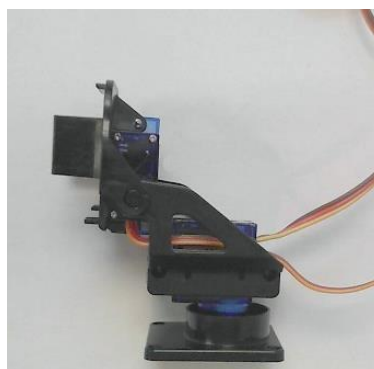
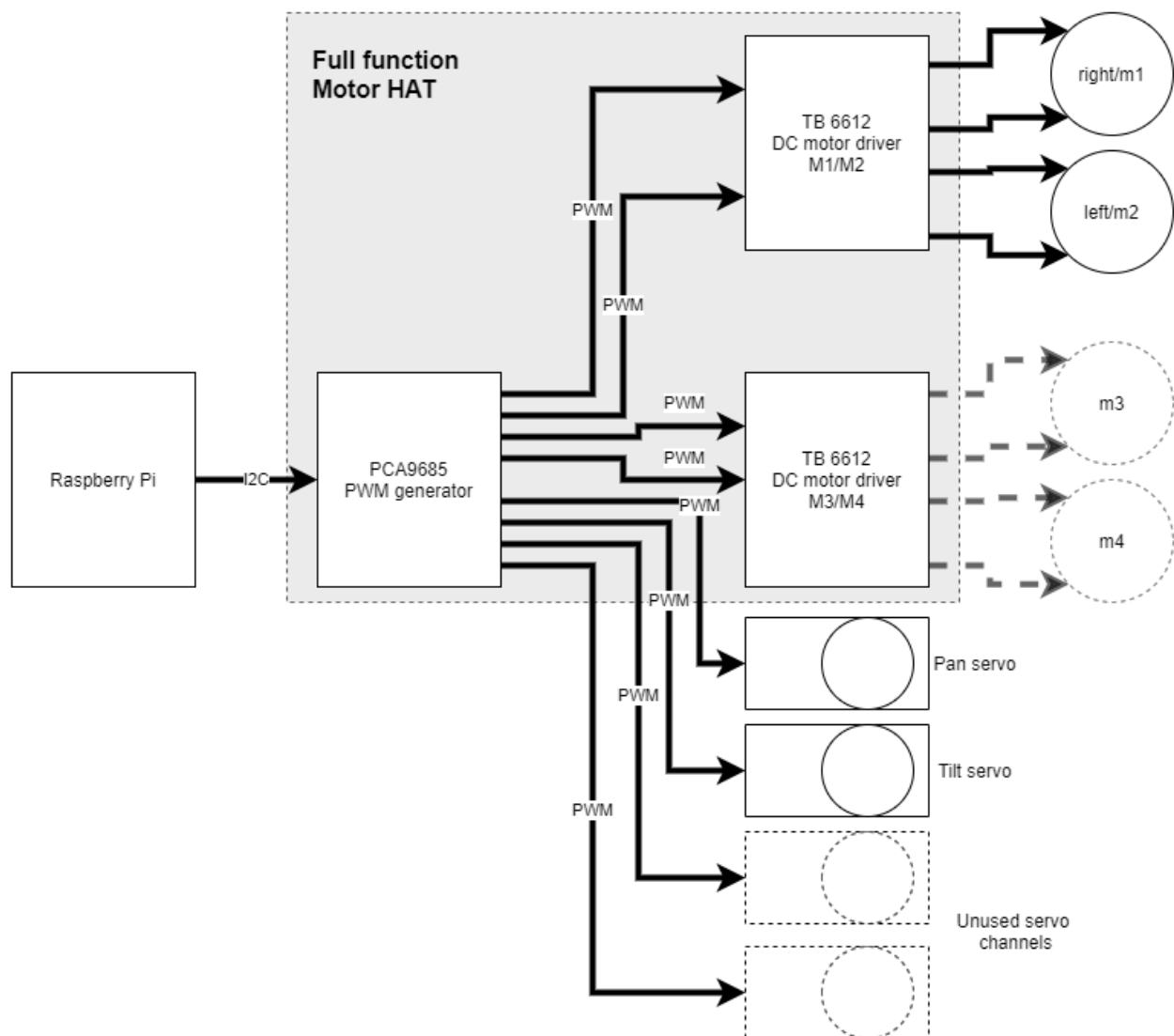


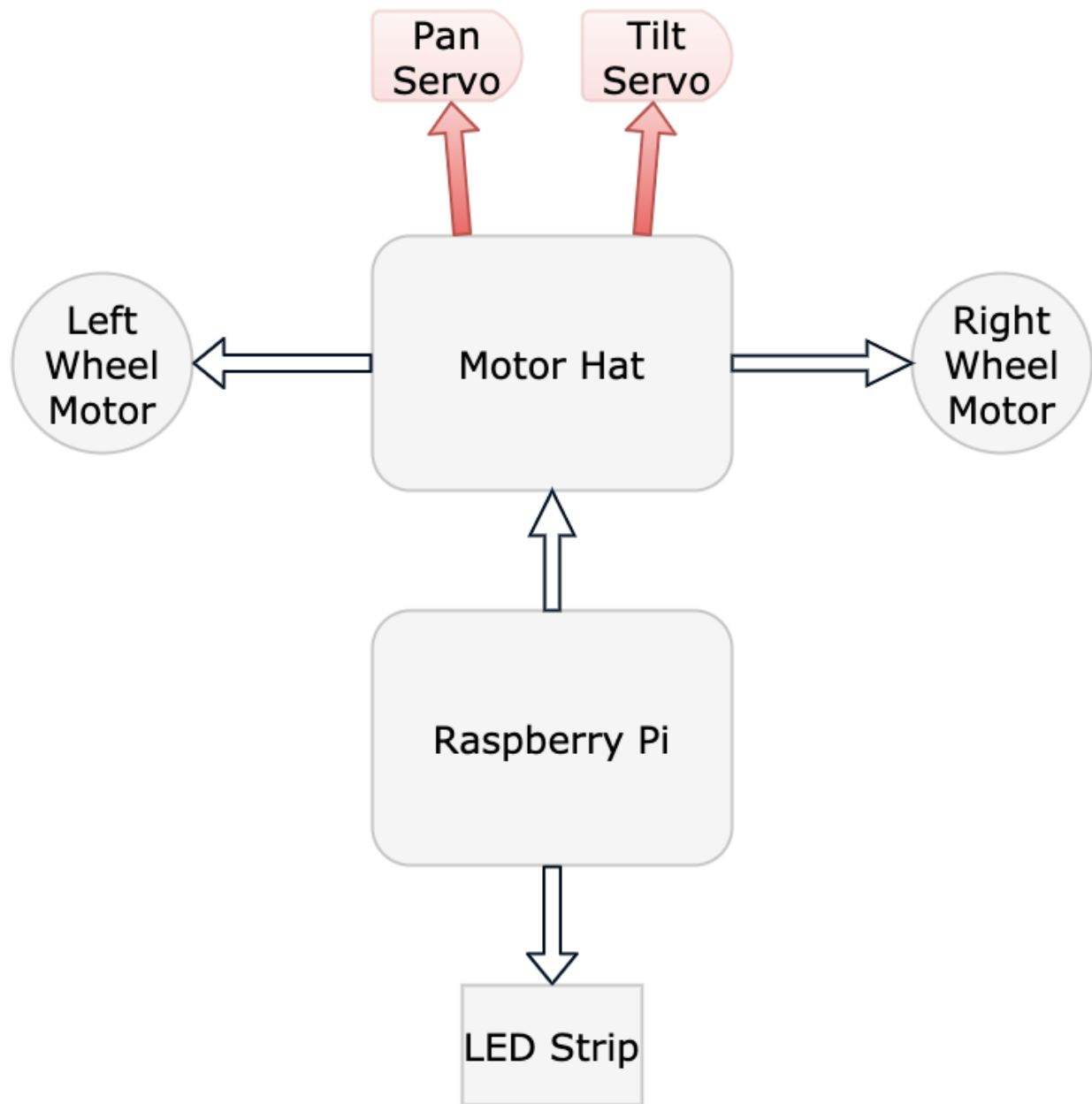
Chapter 10: Using Python to Control Servo Motors

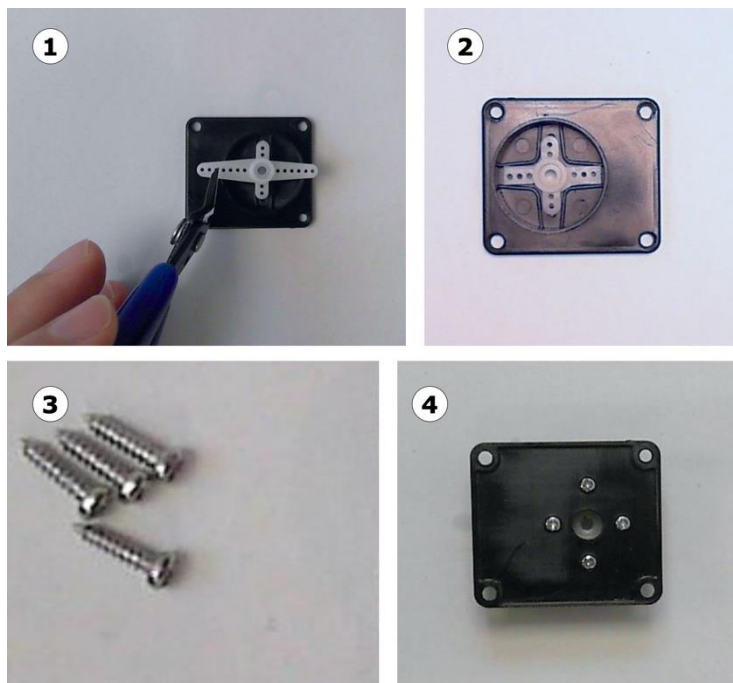
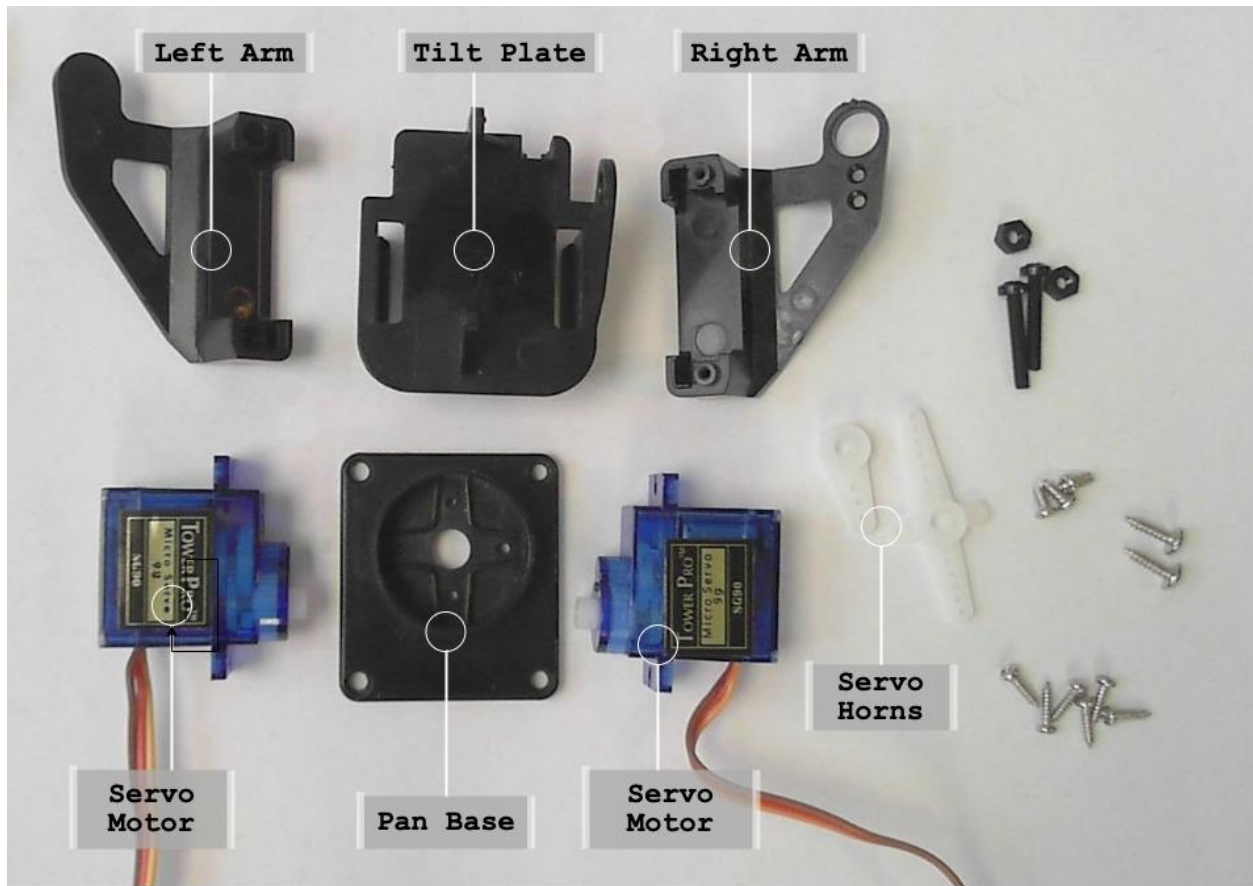


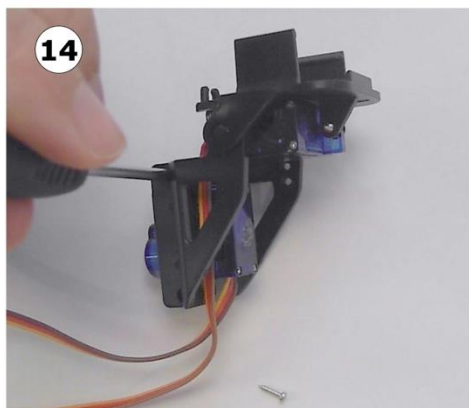
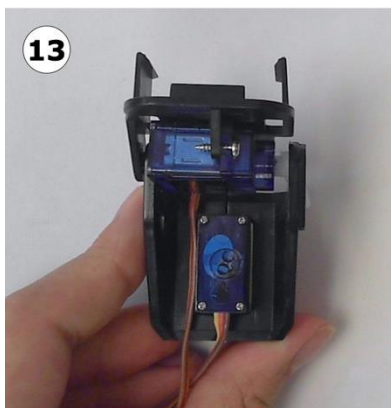
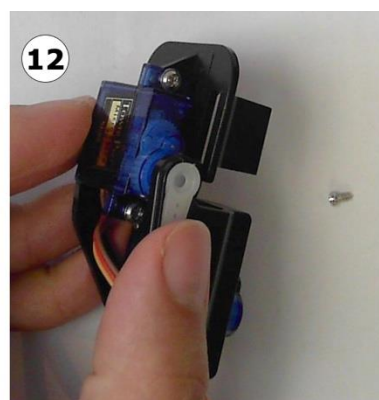
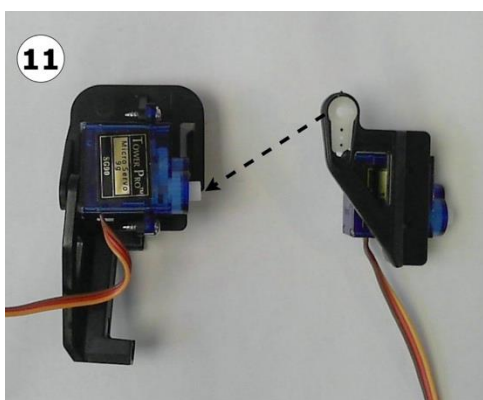
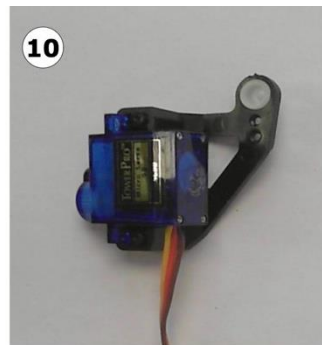
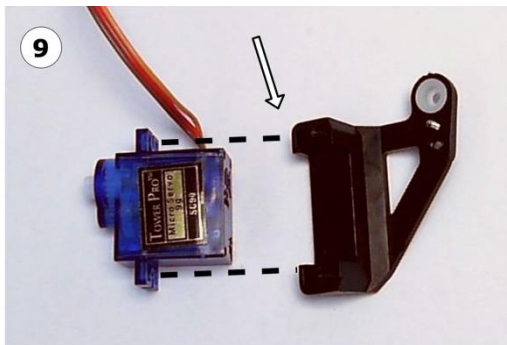
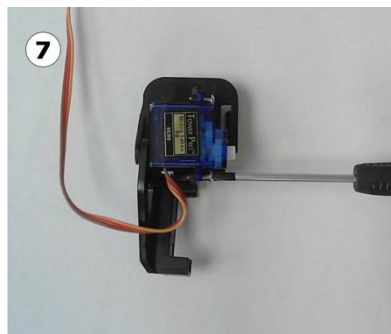
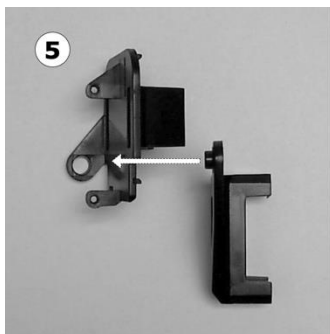


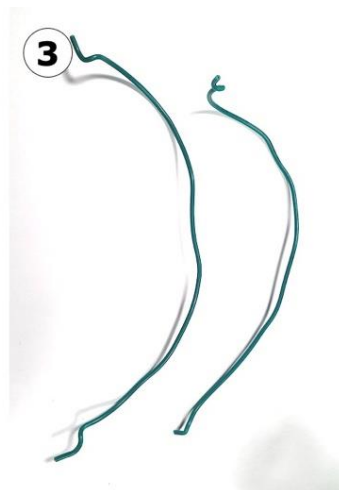
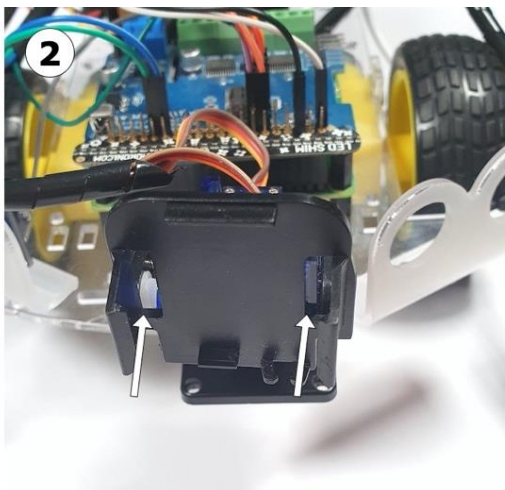
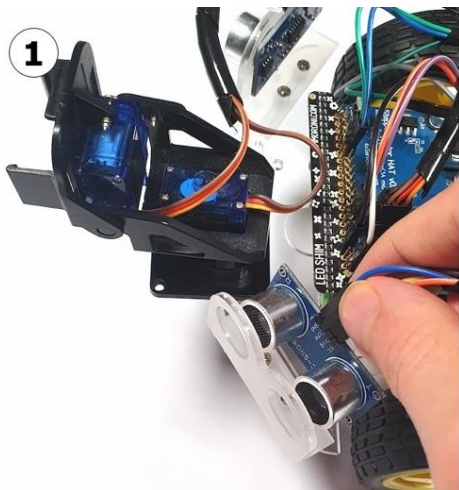
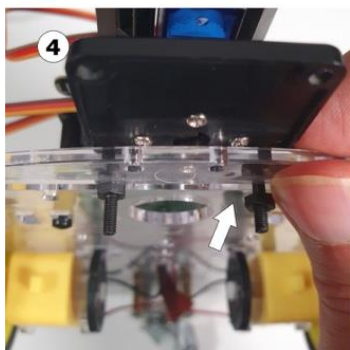
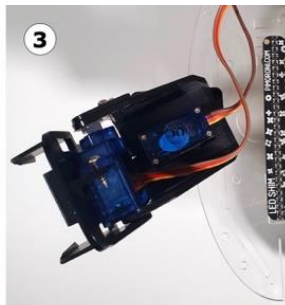
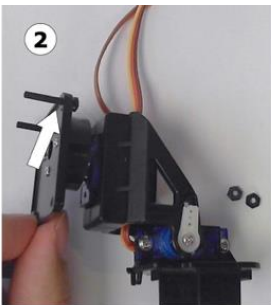
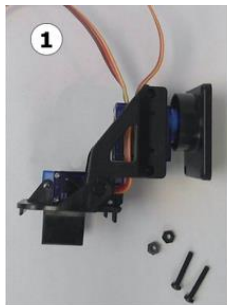
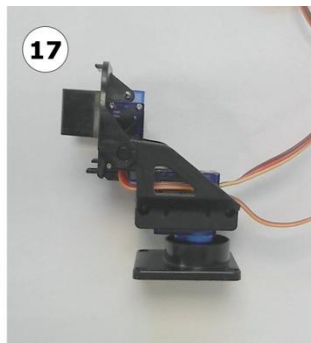
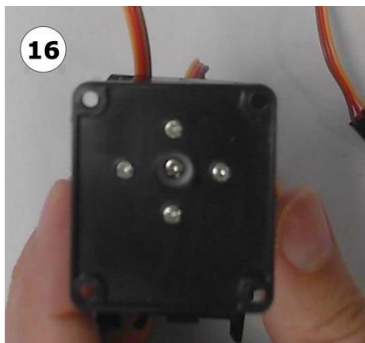
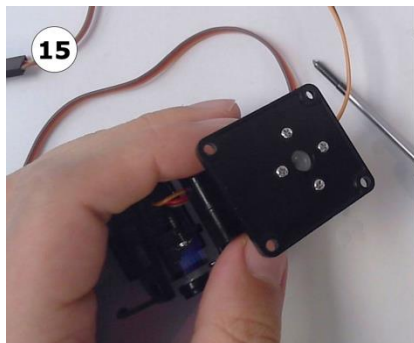


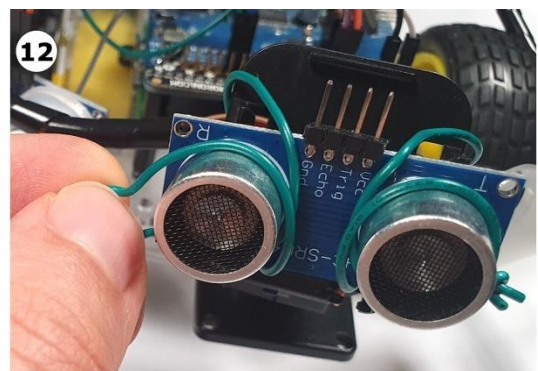
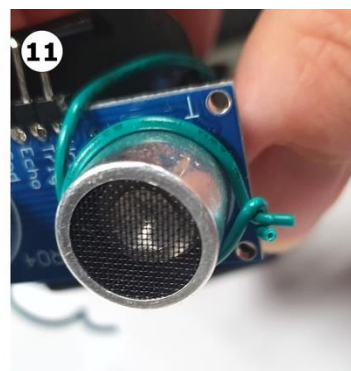
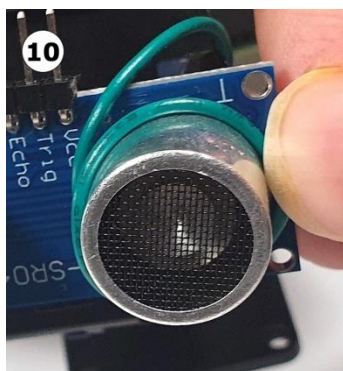
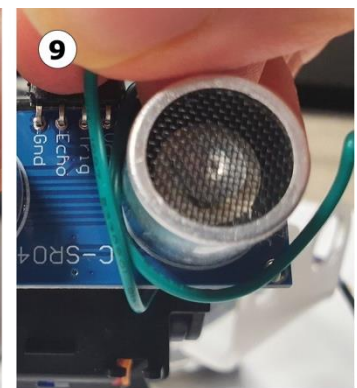
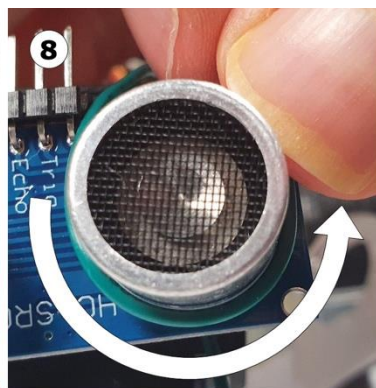
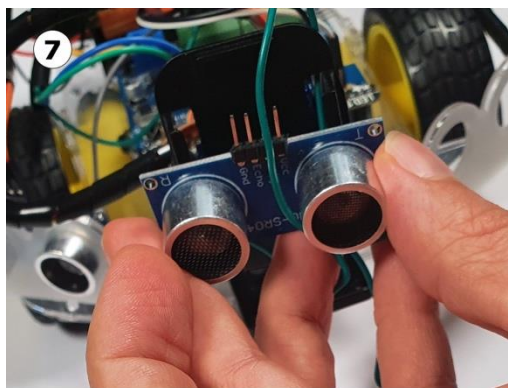
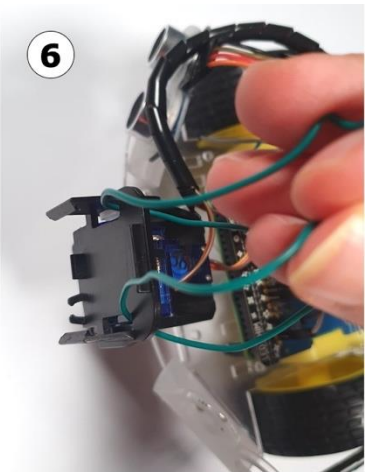
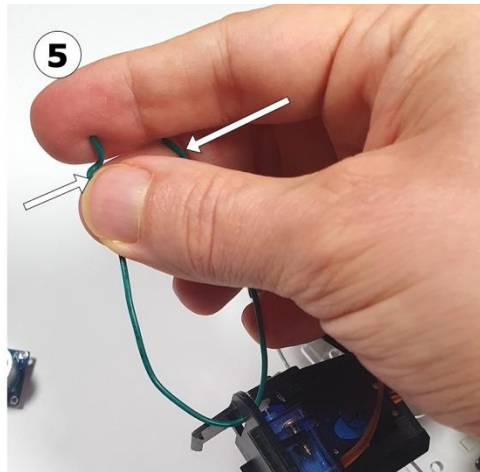
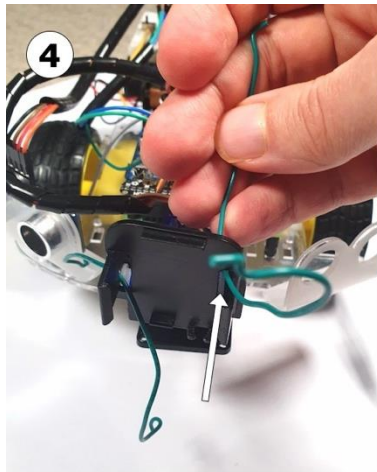


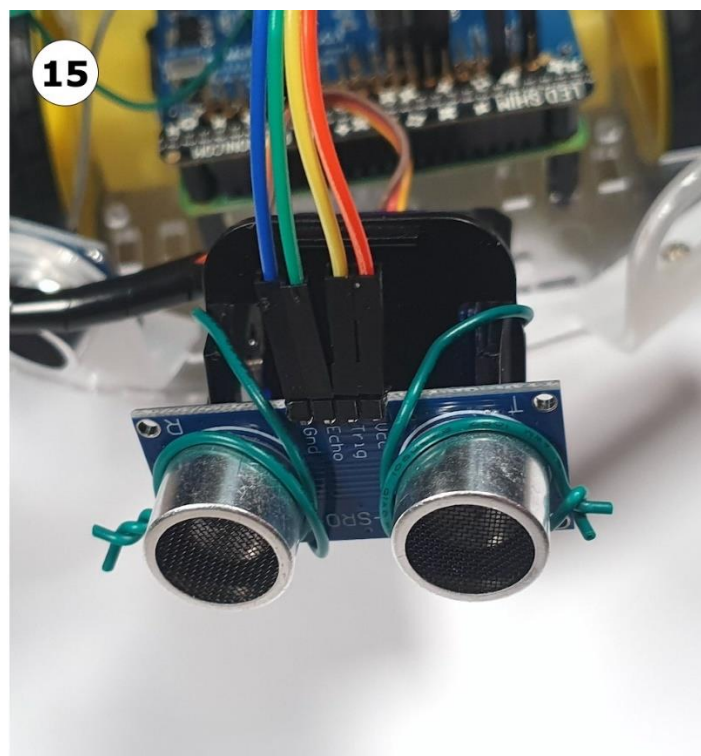
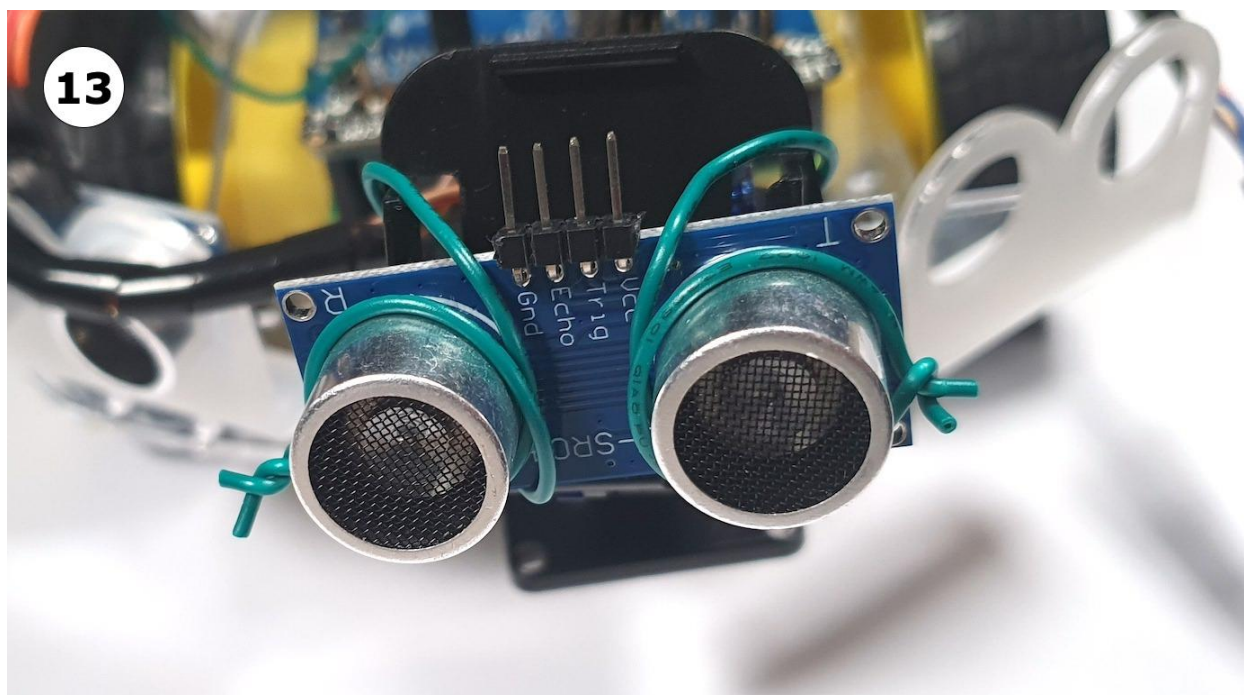


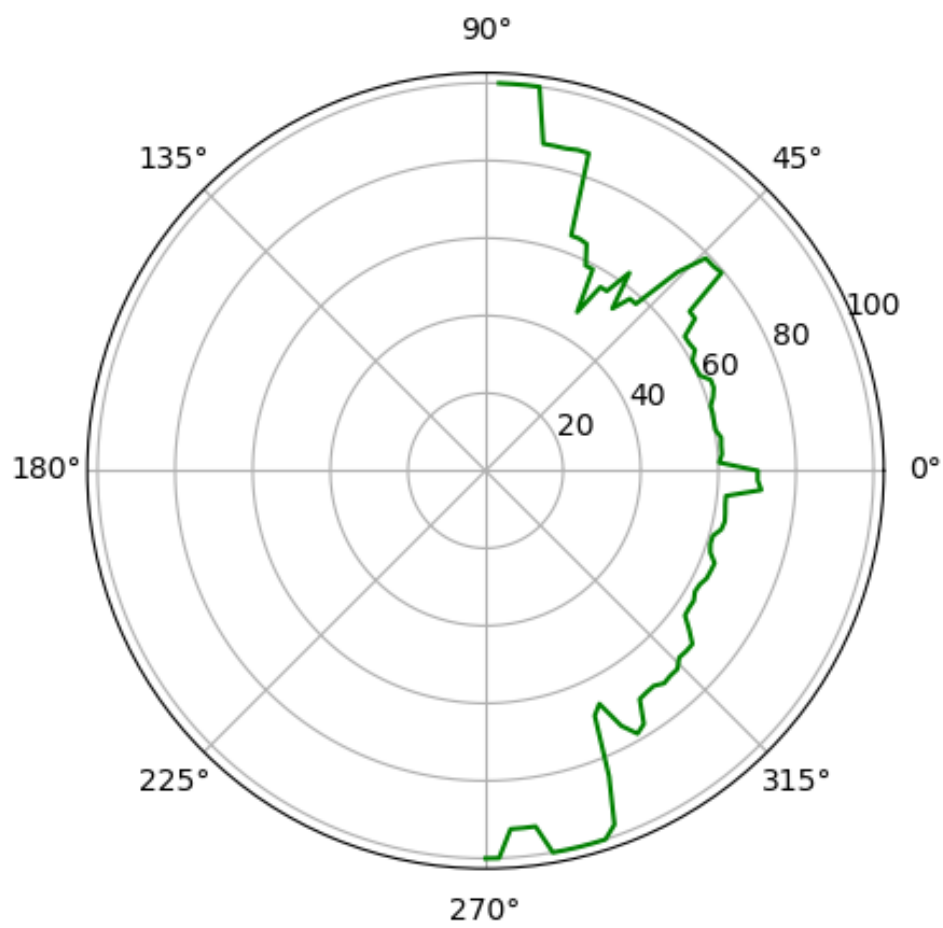




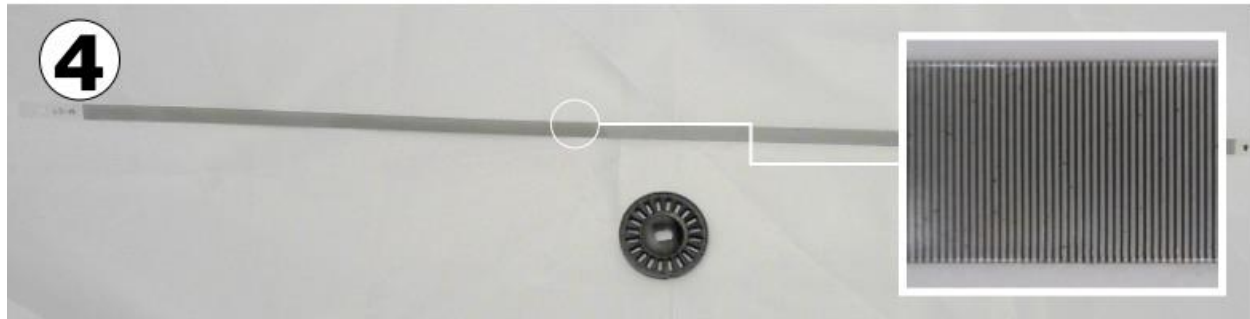


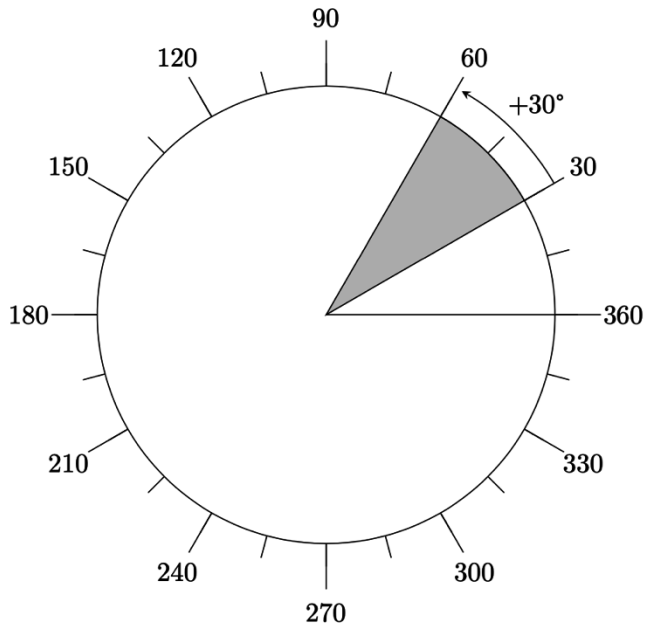




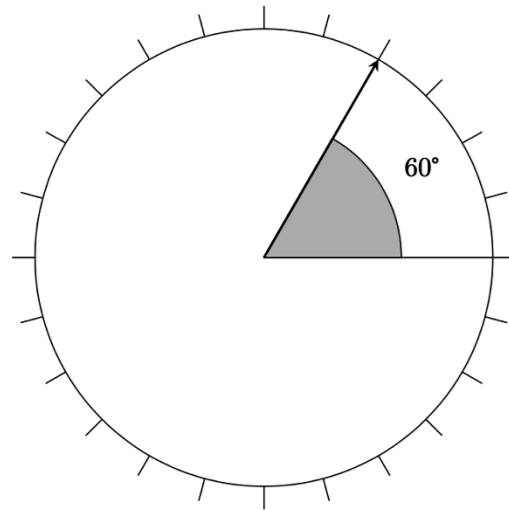


Chapter 11: Programming Encoders with Python

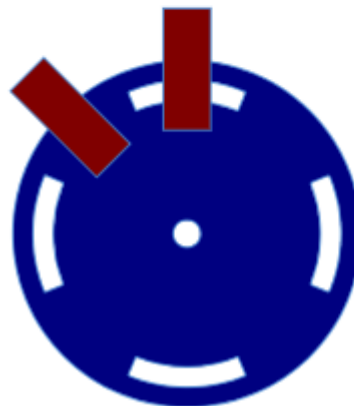
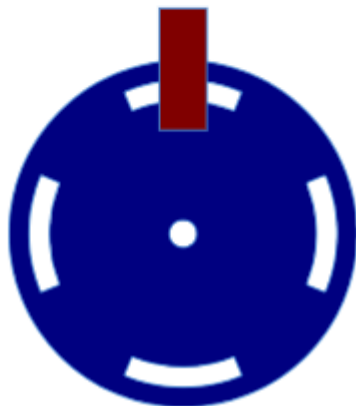
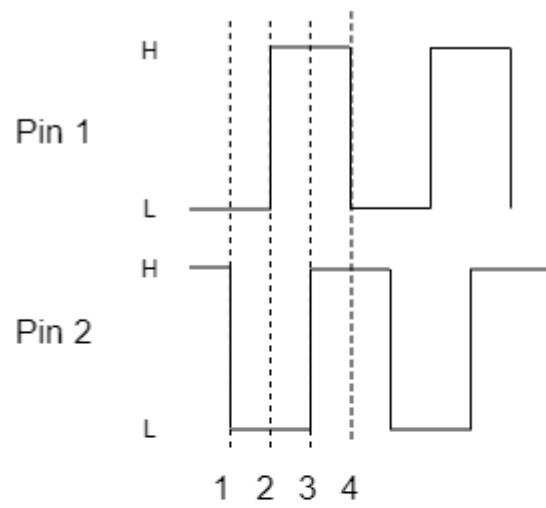
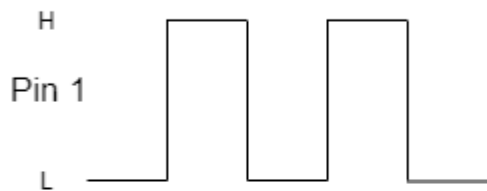


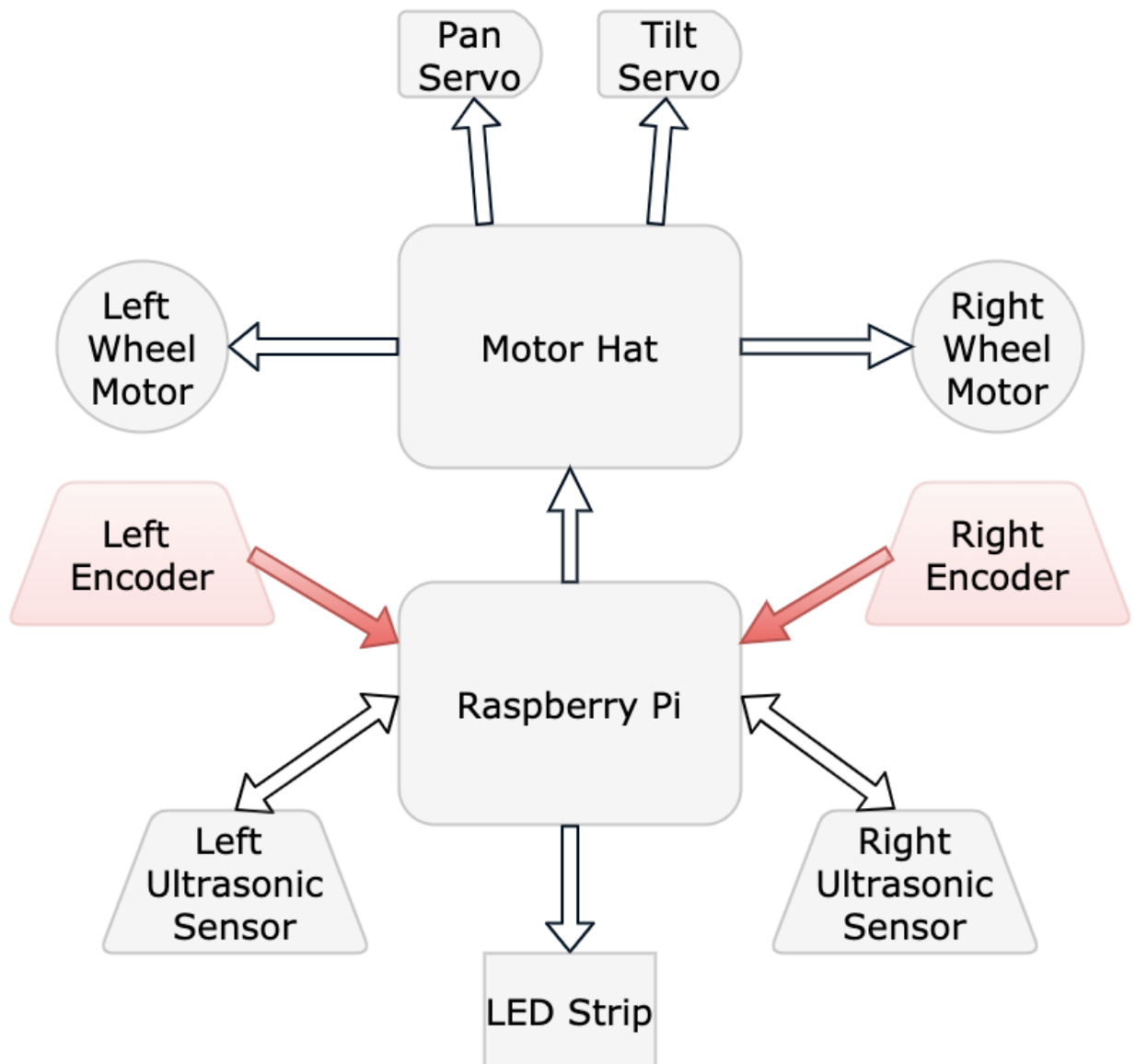


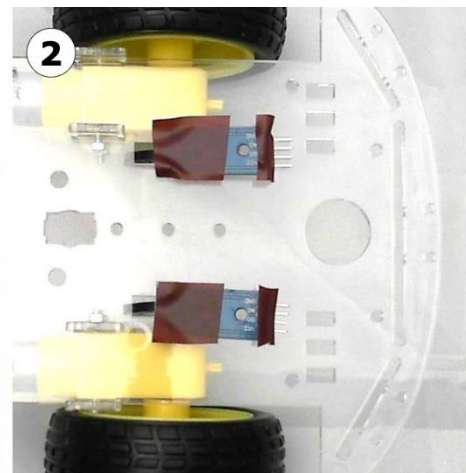
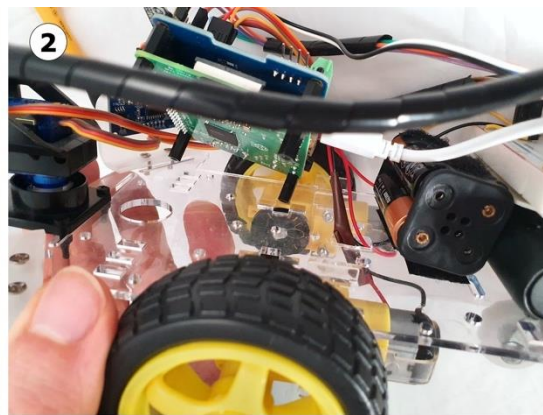
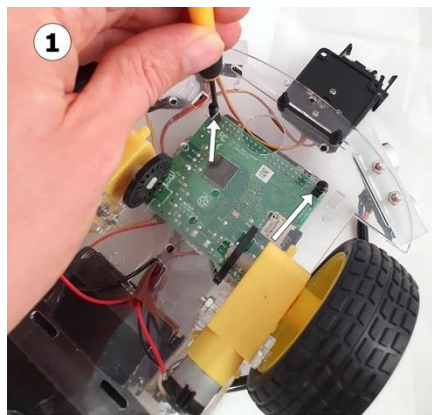
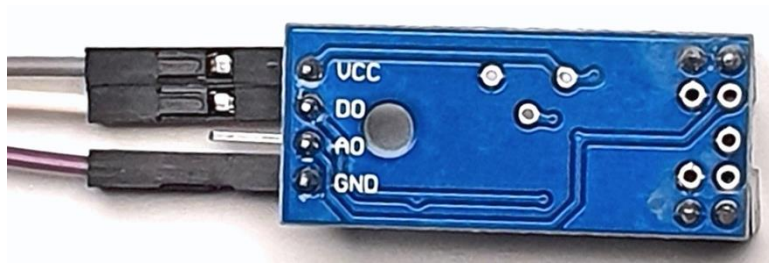
Speed Only

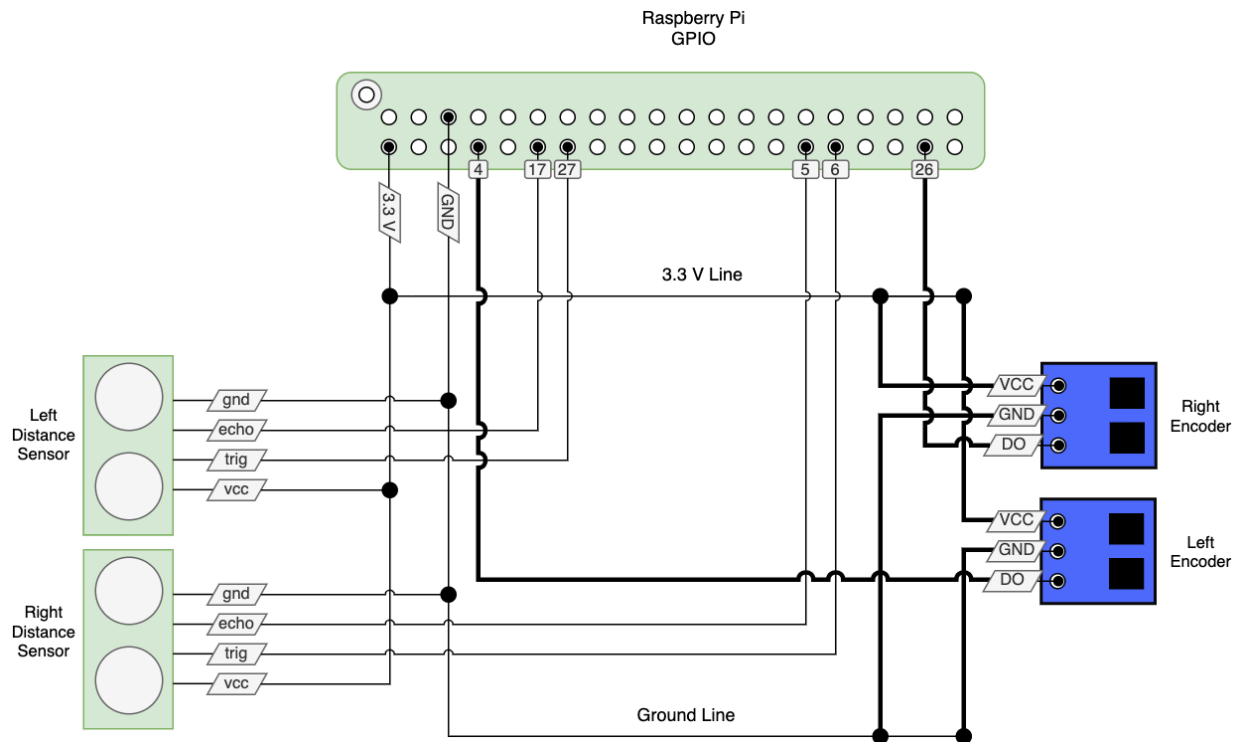


Speed With Direction

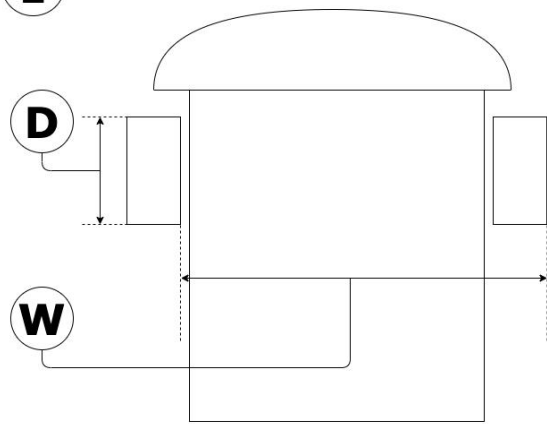






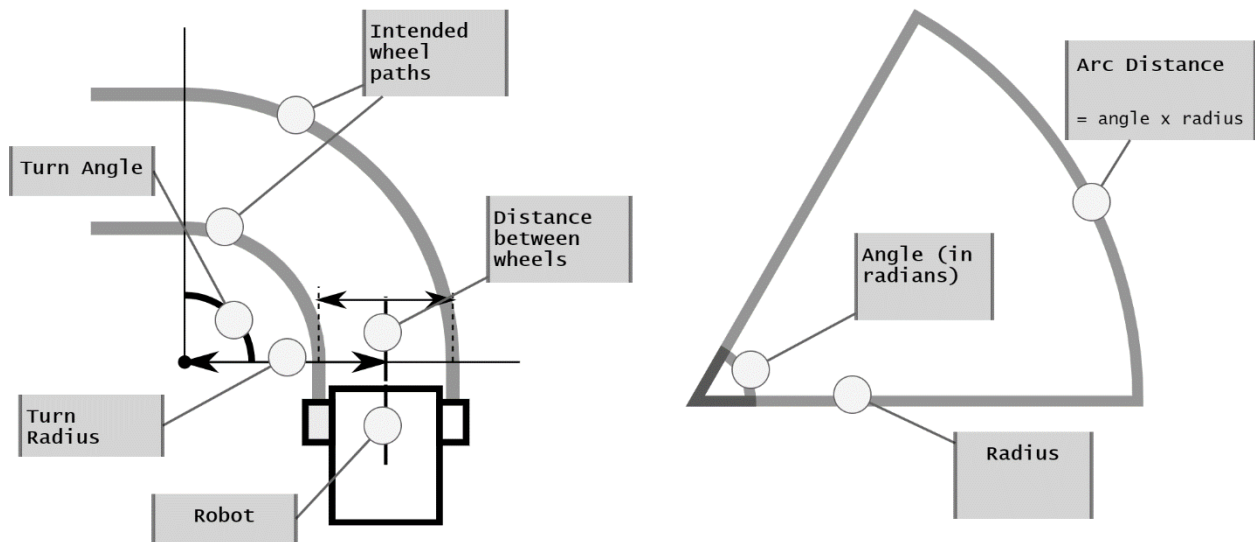
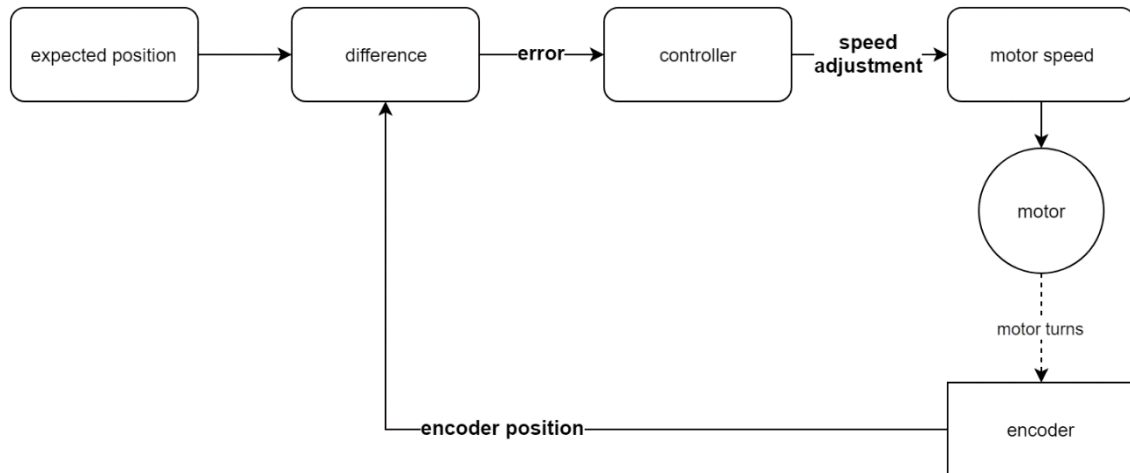


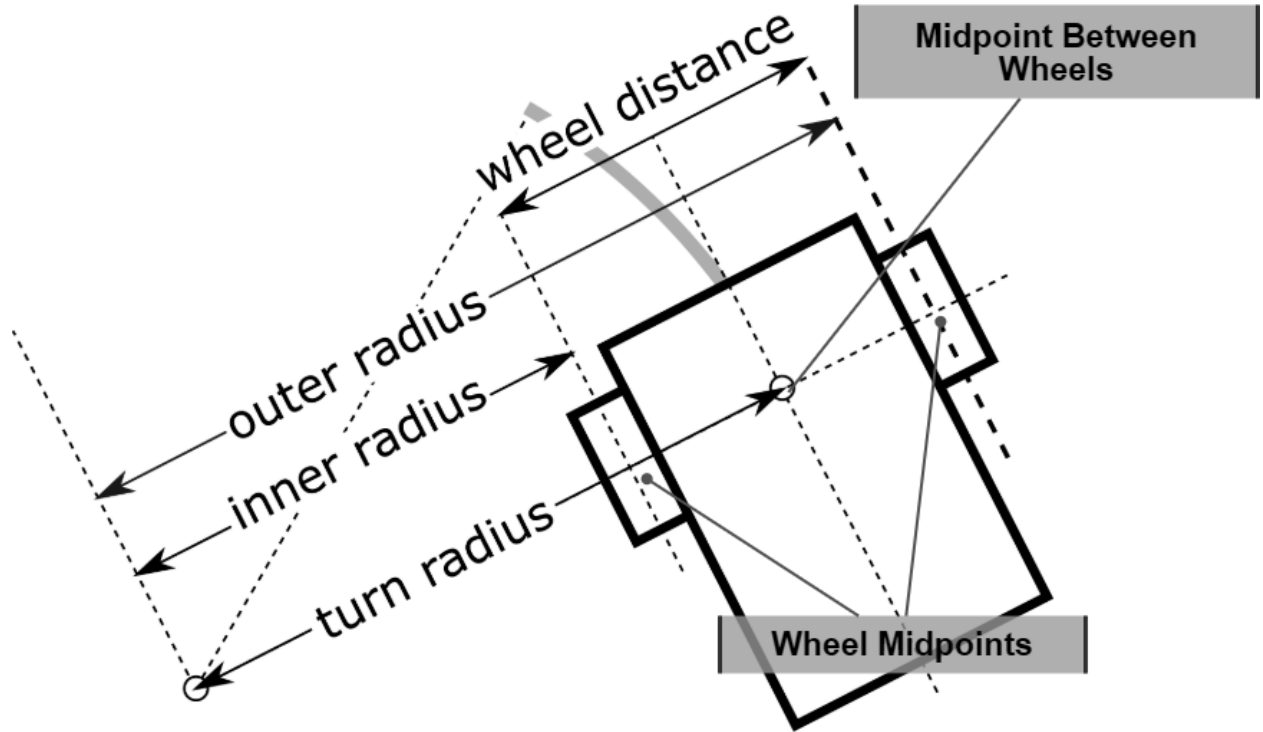
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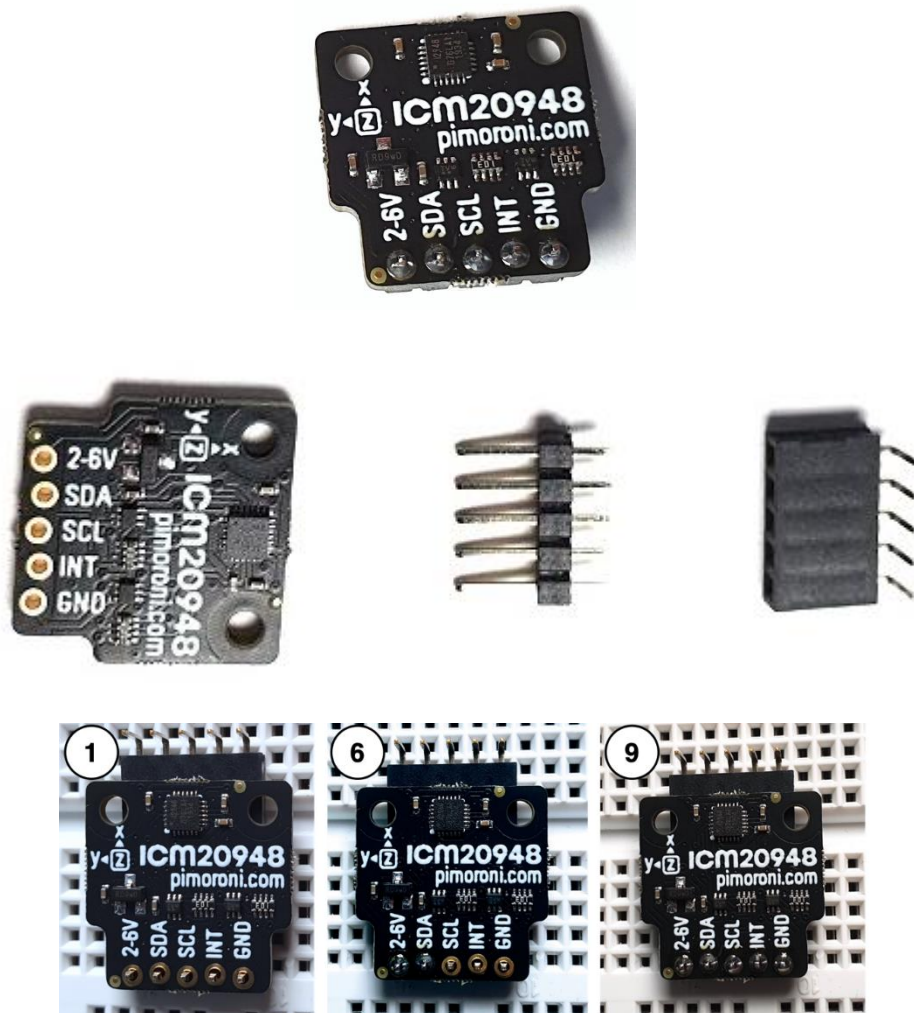
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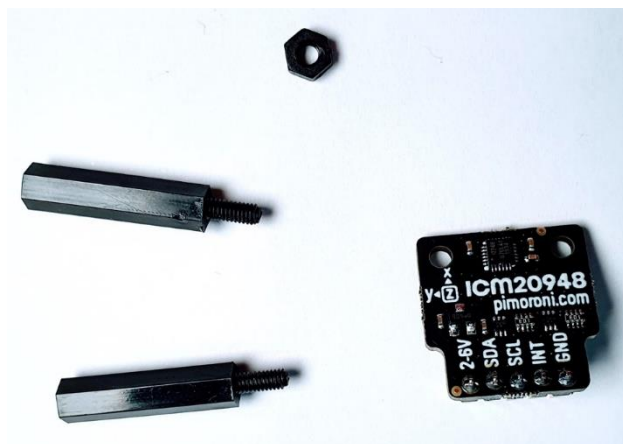
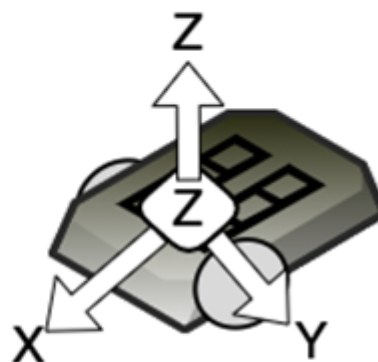
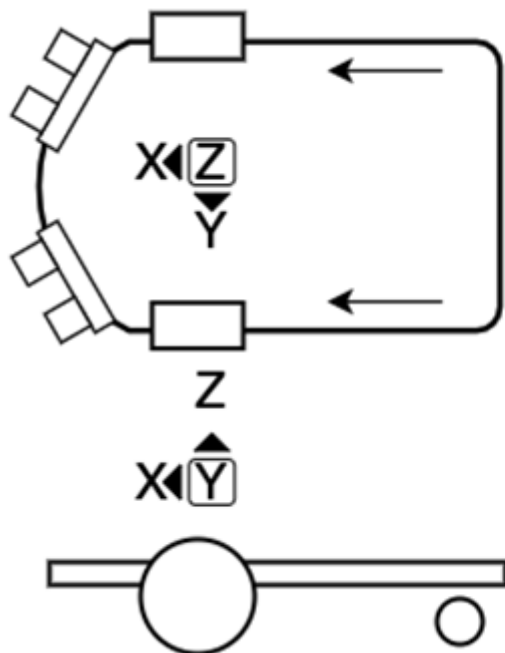


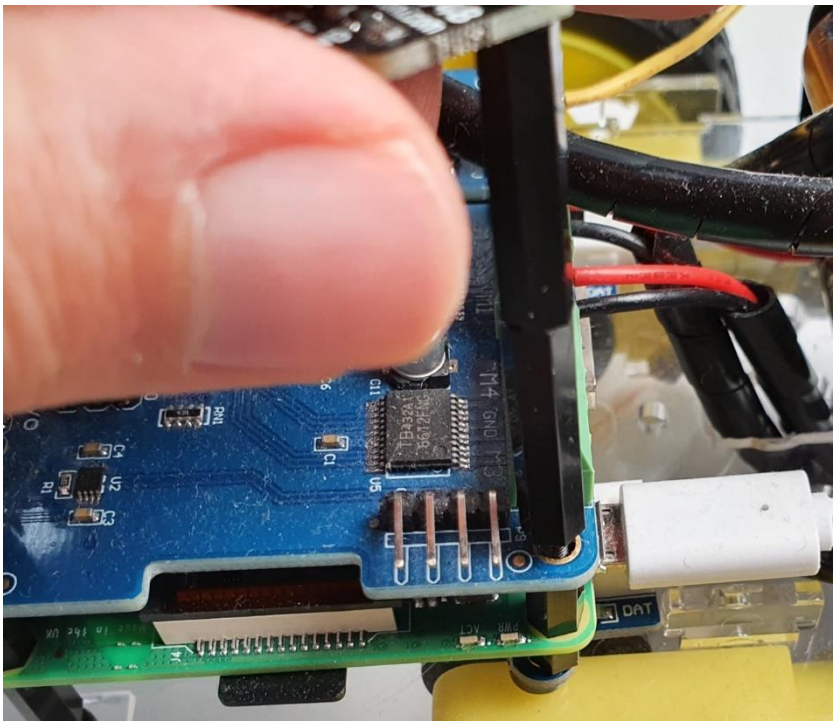
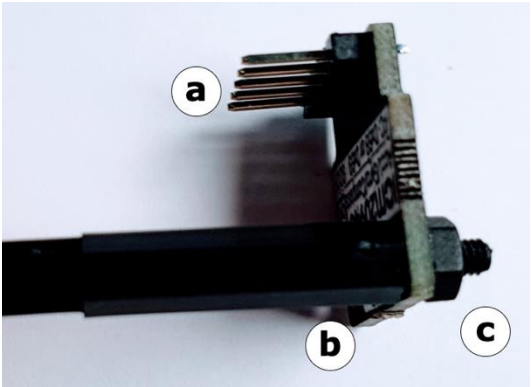


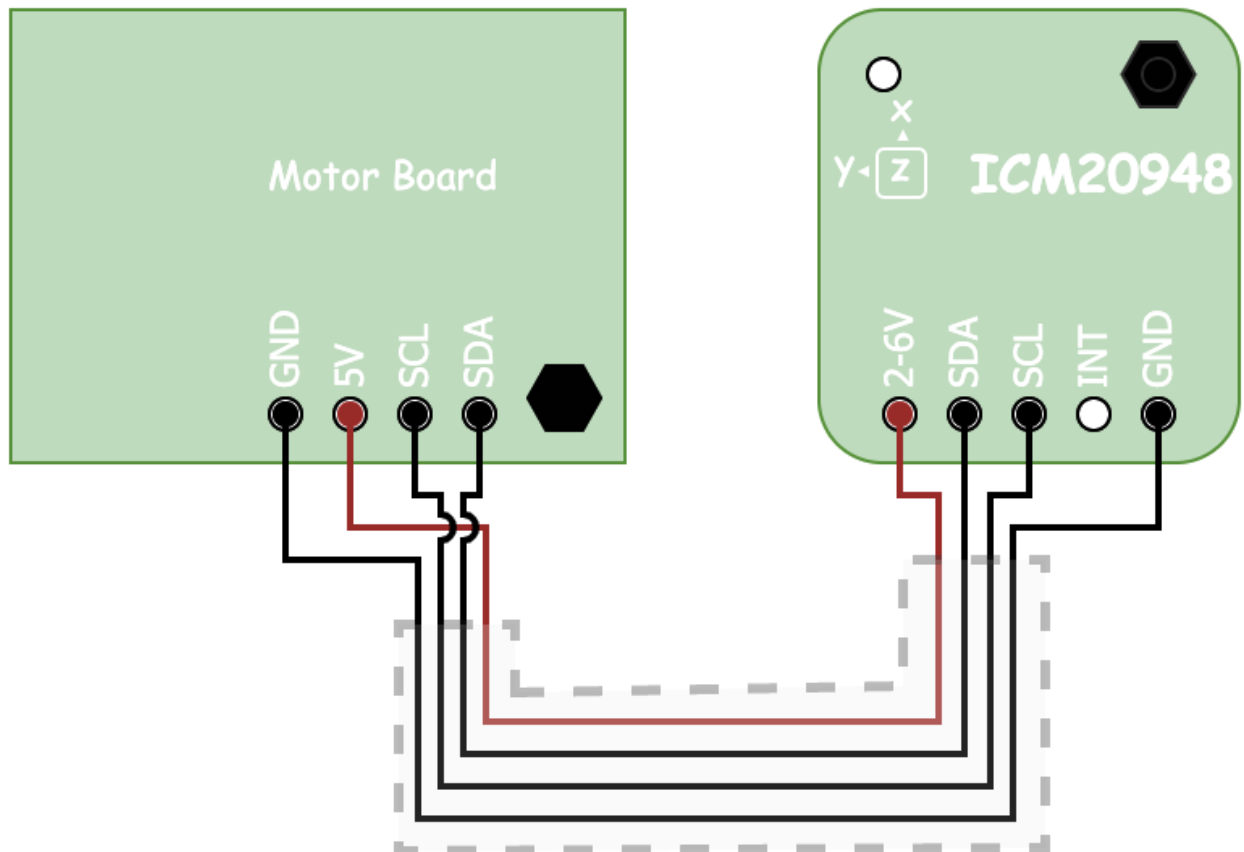
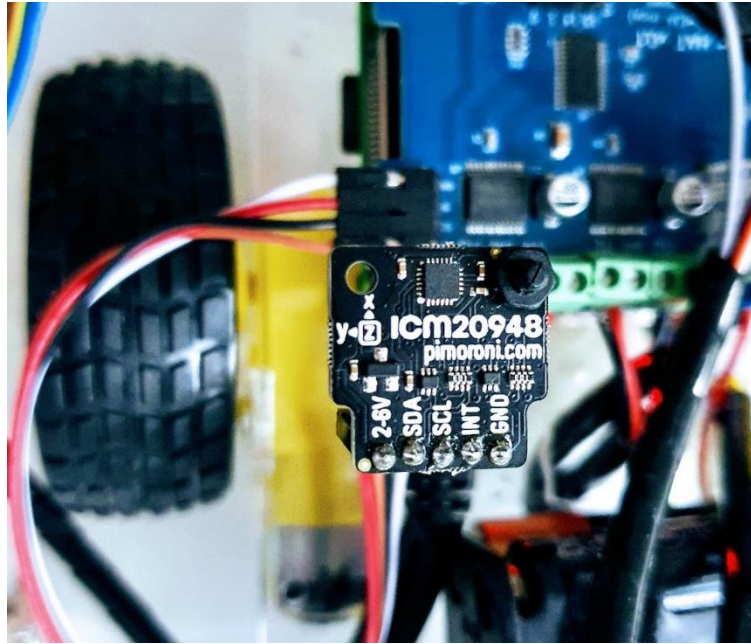


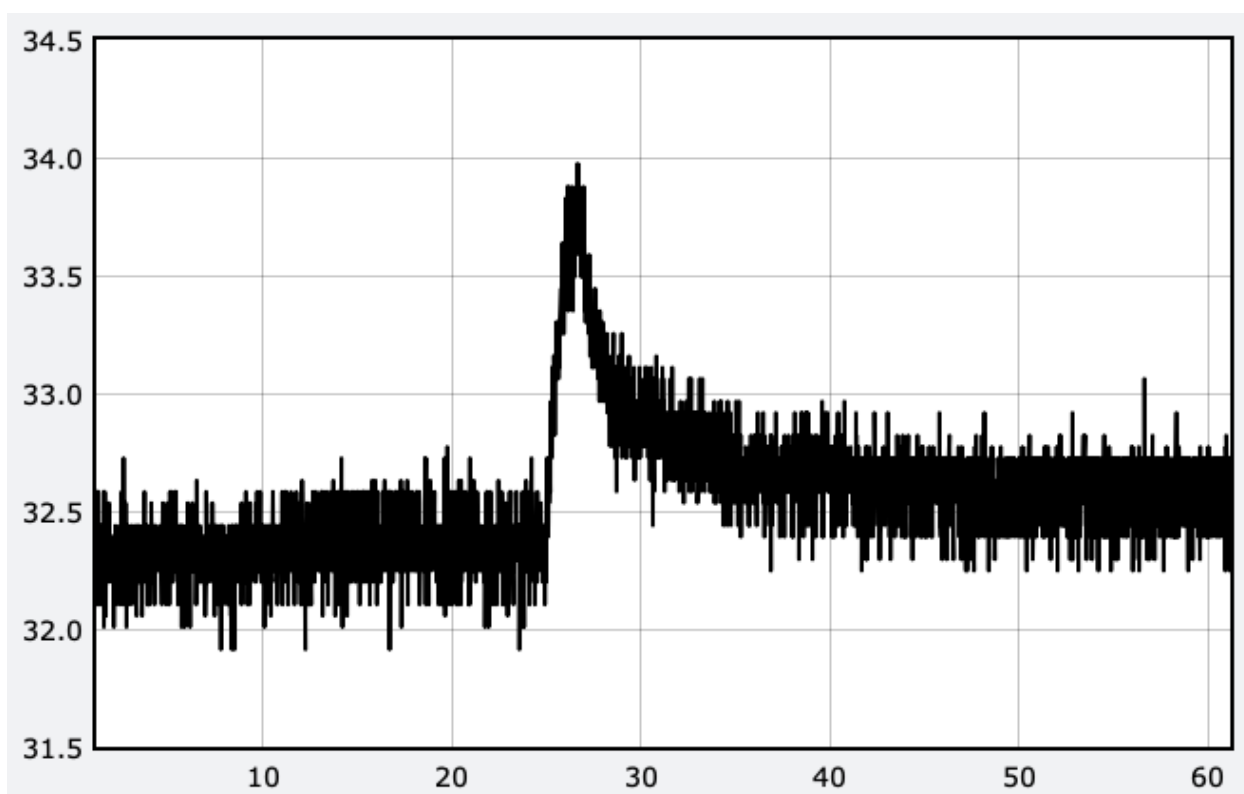
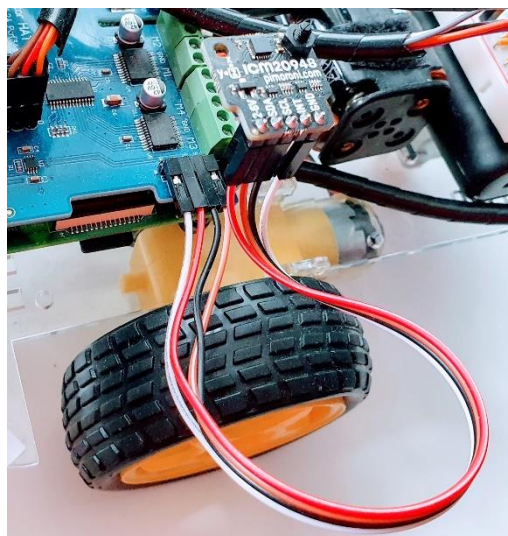
Chapter 12: IMU Programming with Python

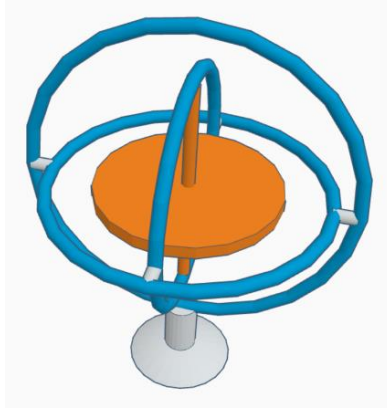




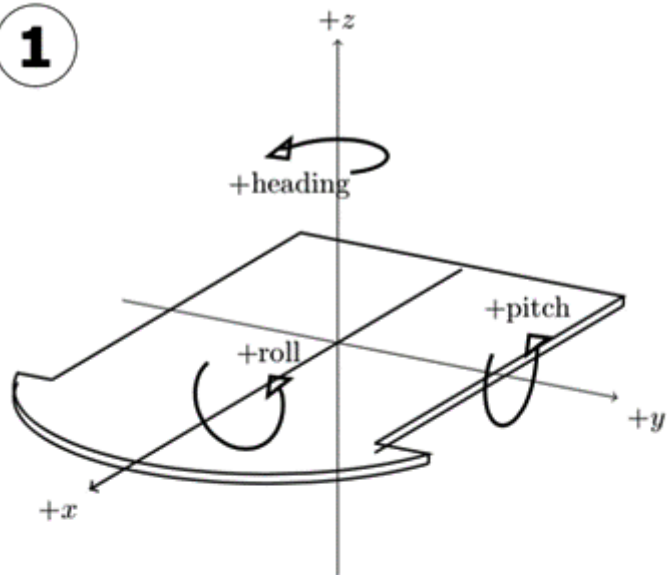




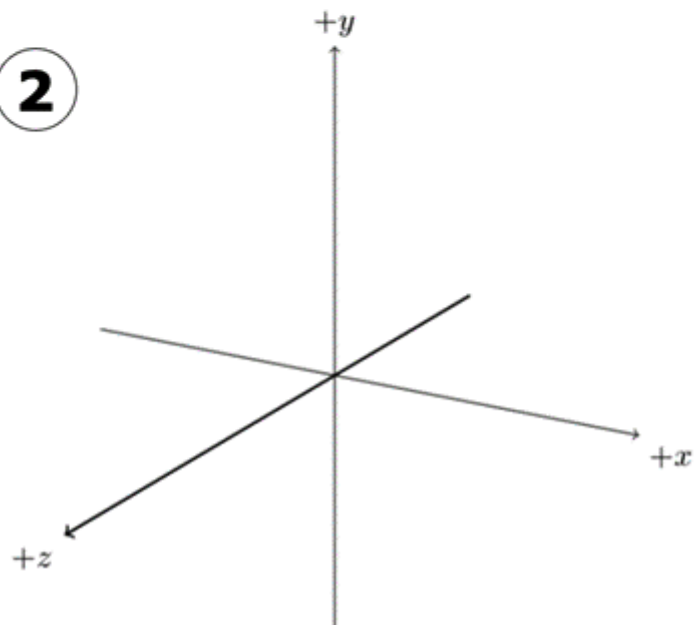


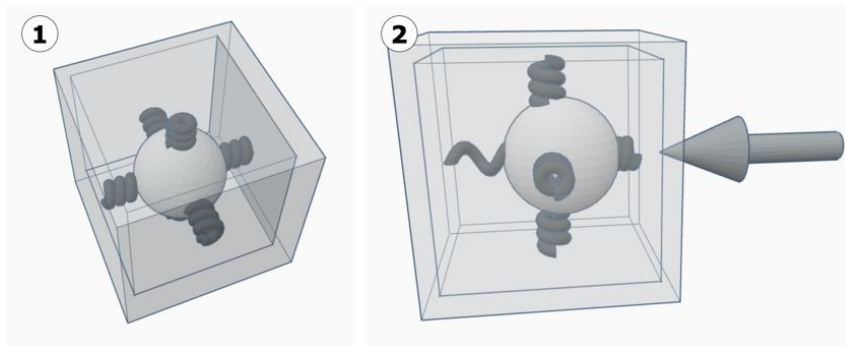
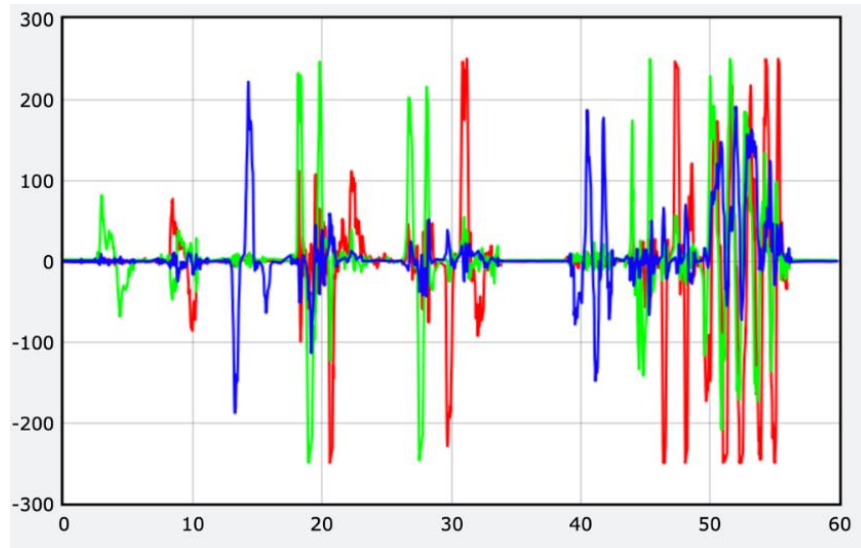
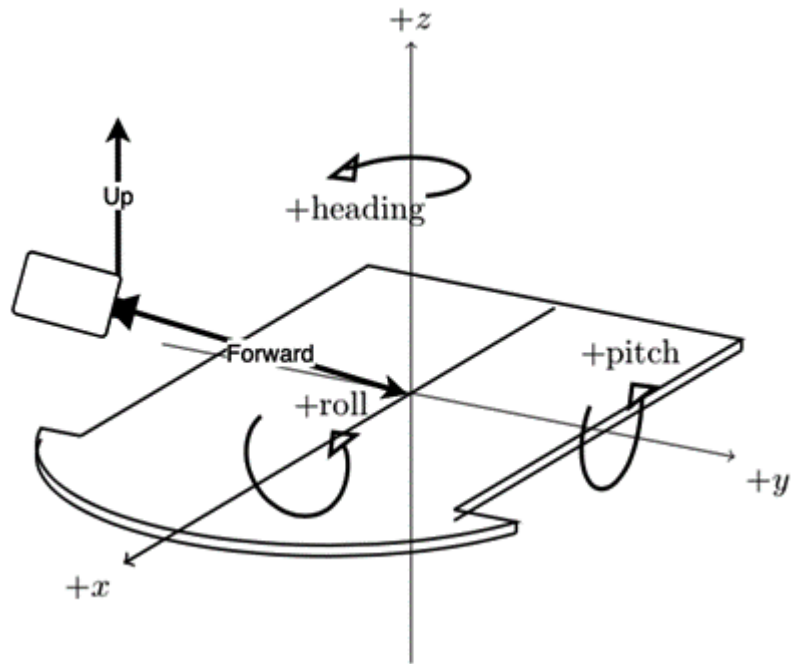


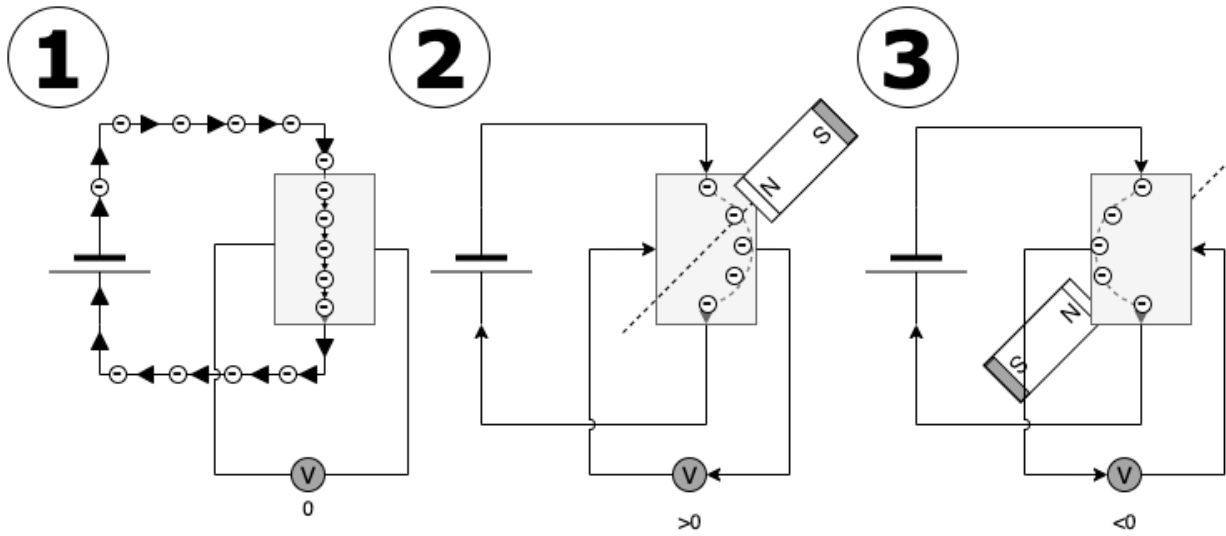
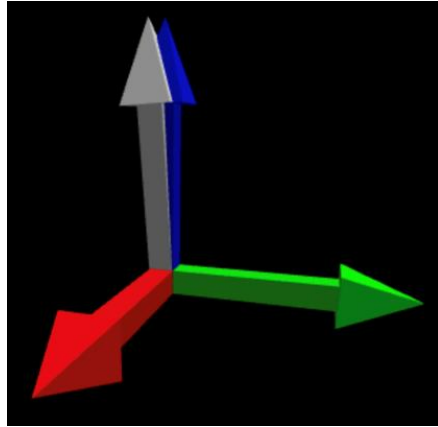
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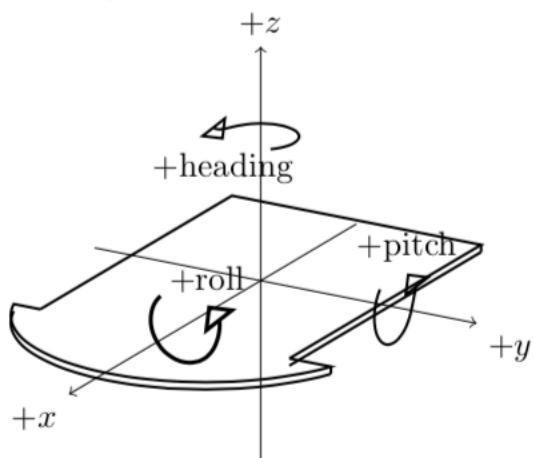
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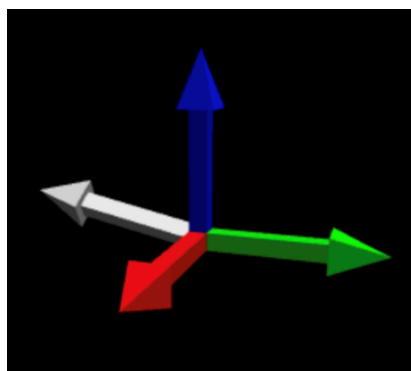
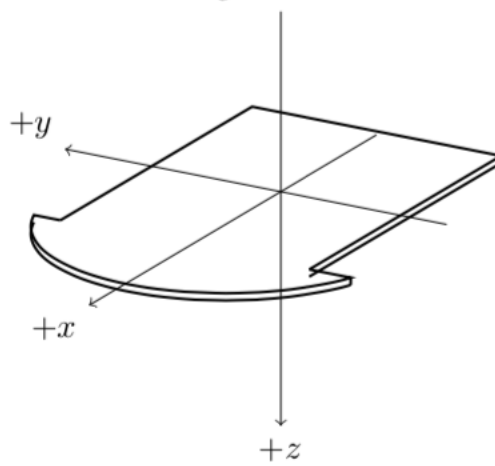




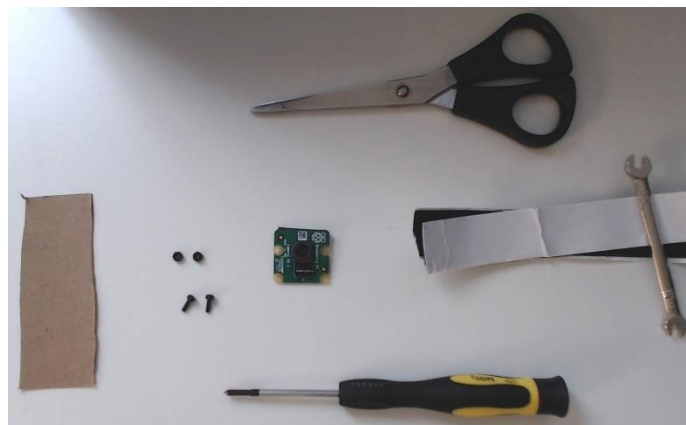
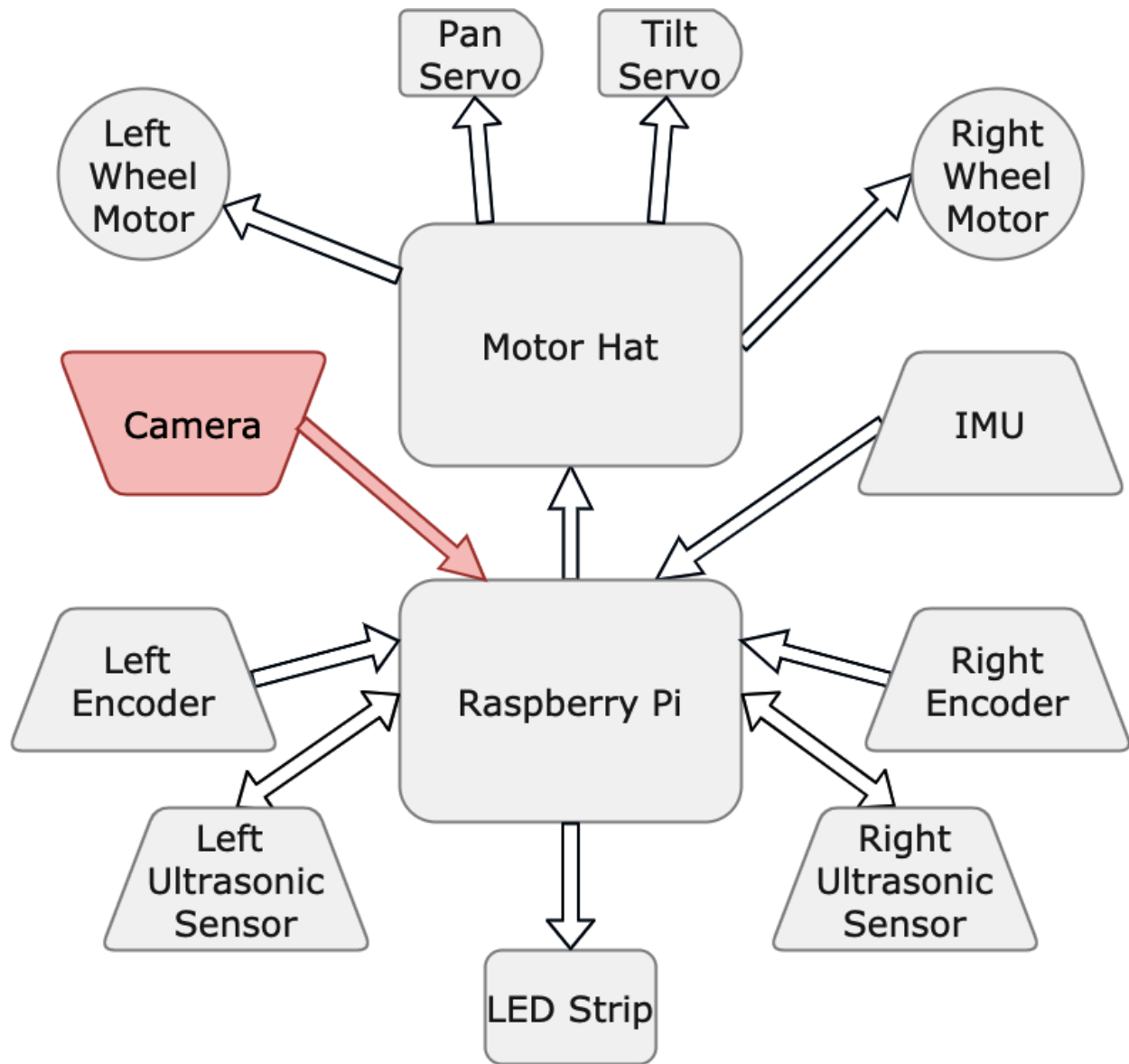
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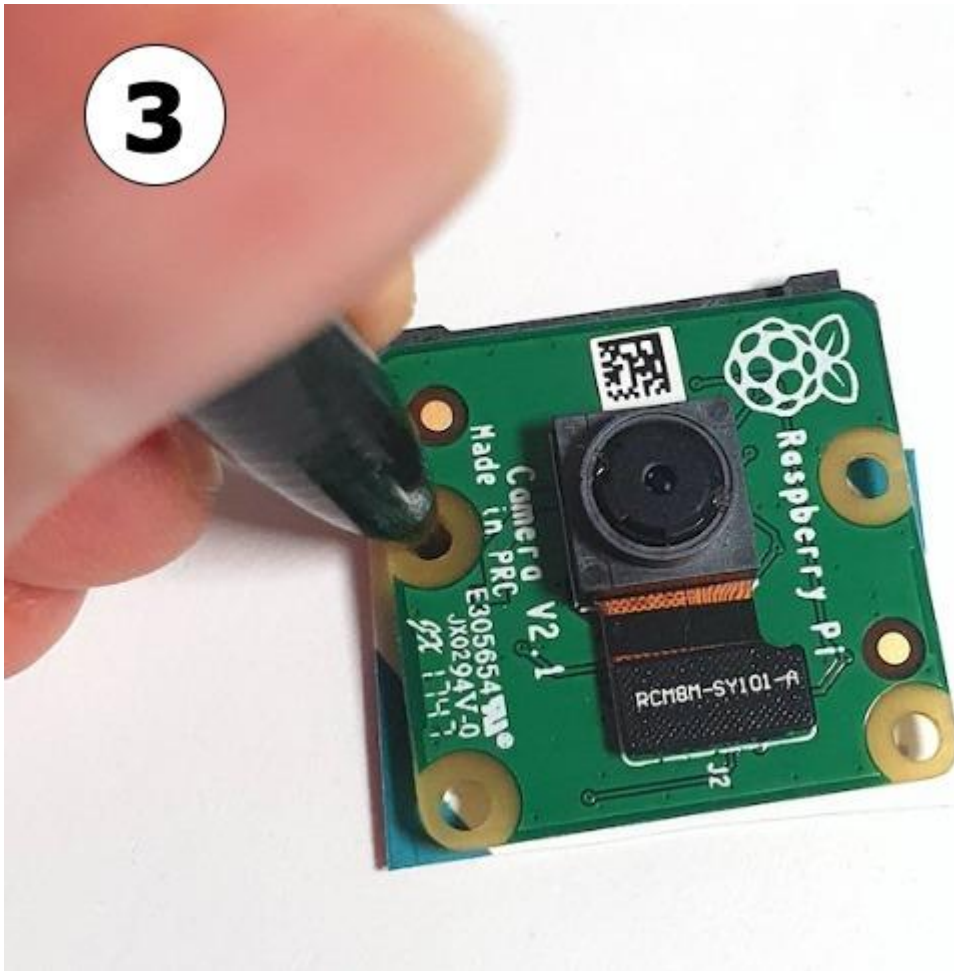
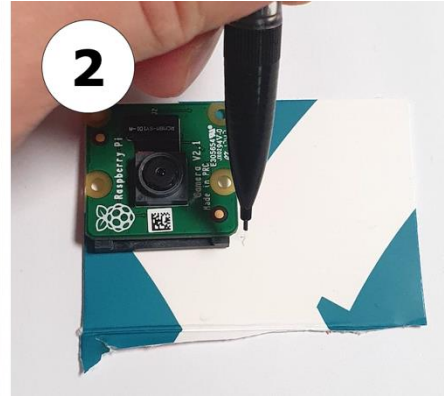


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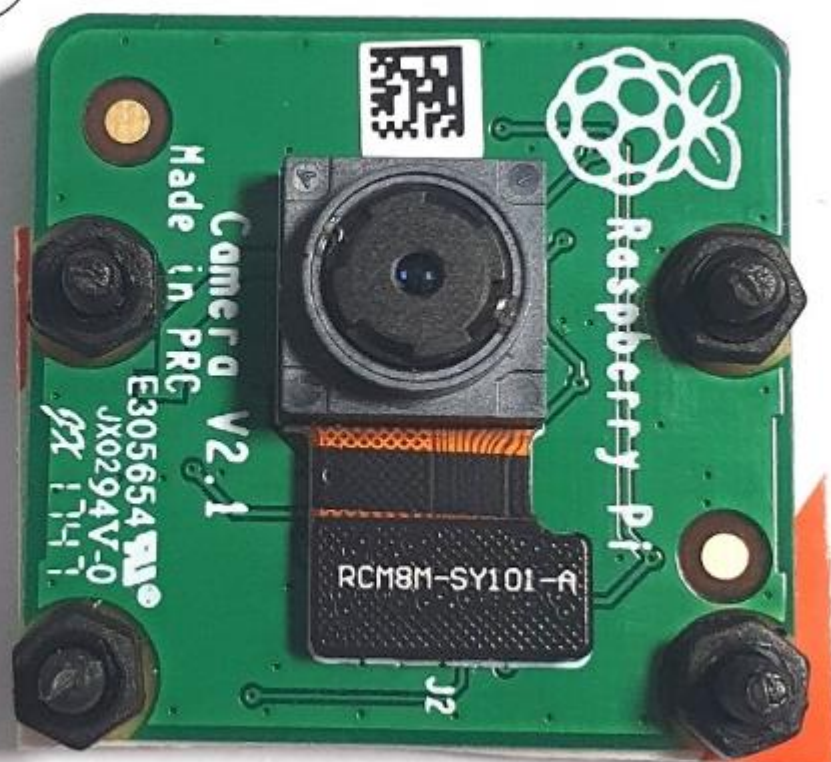


Chapter 13: Robot Vision – Using a Pi Camera and OpenCV

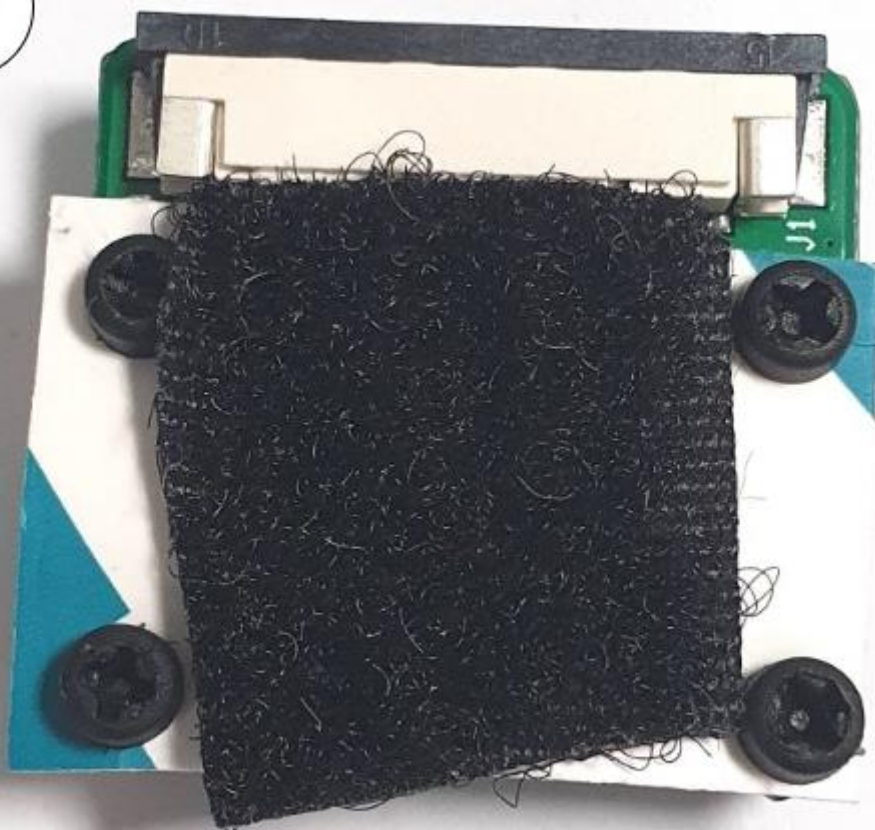


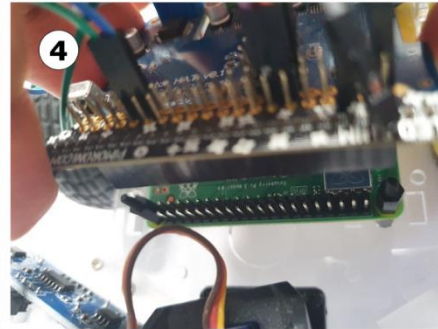
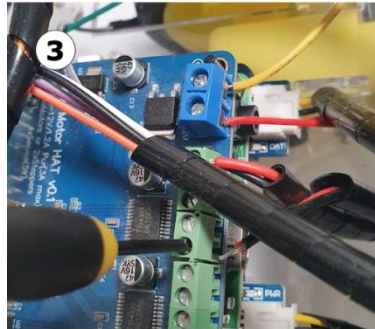
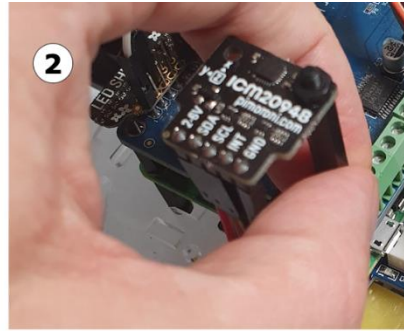
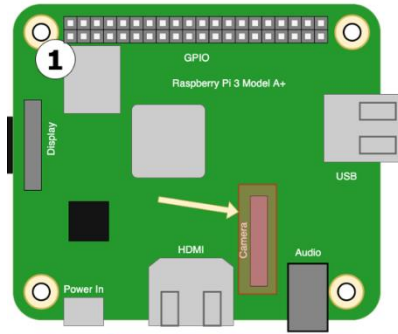


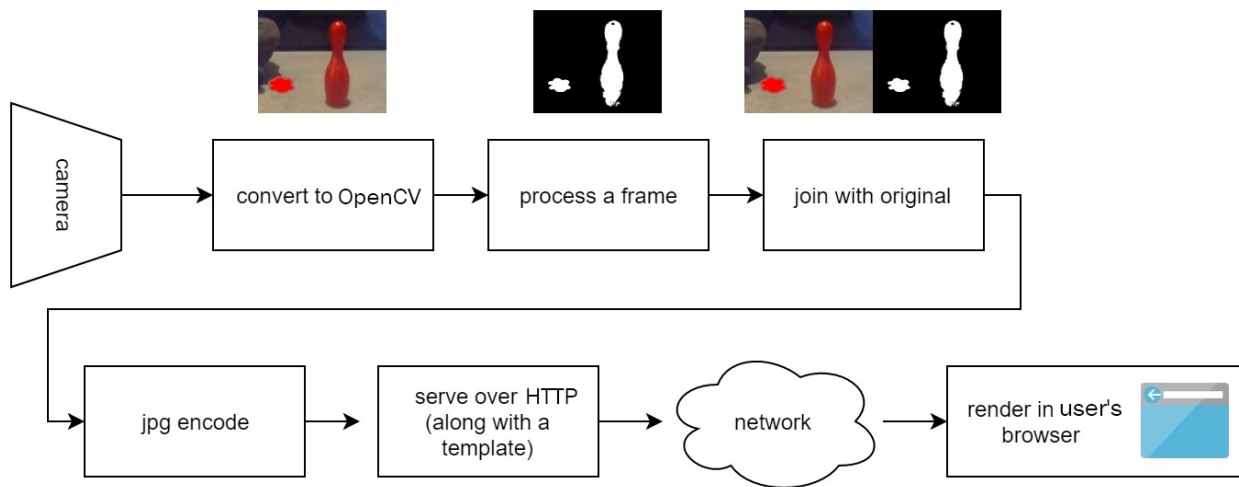
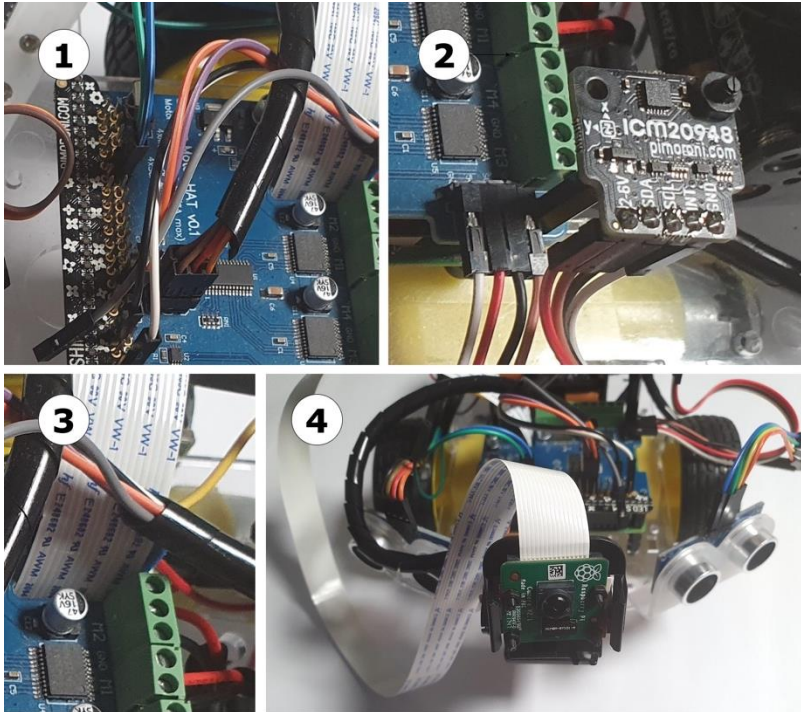
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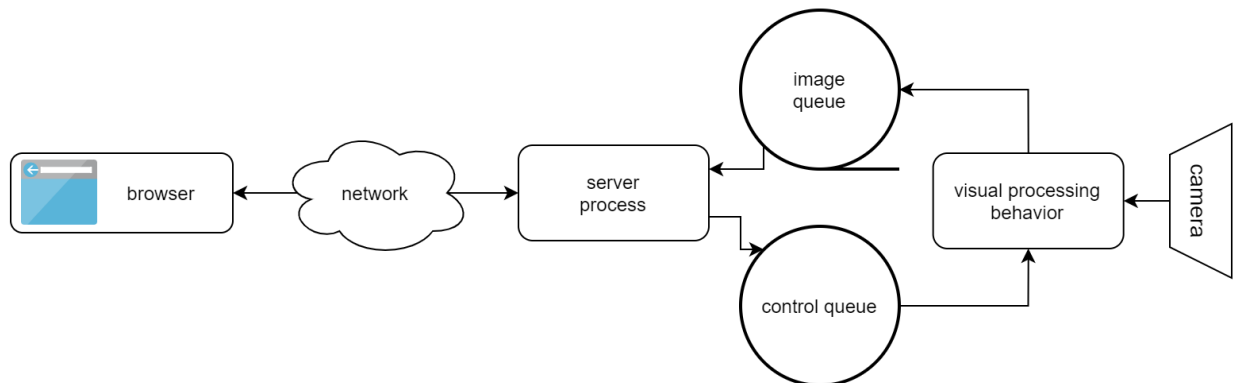
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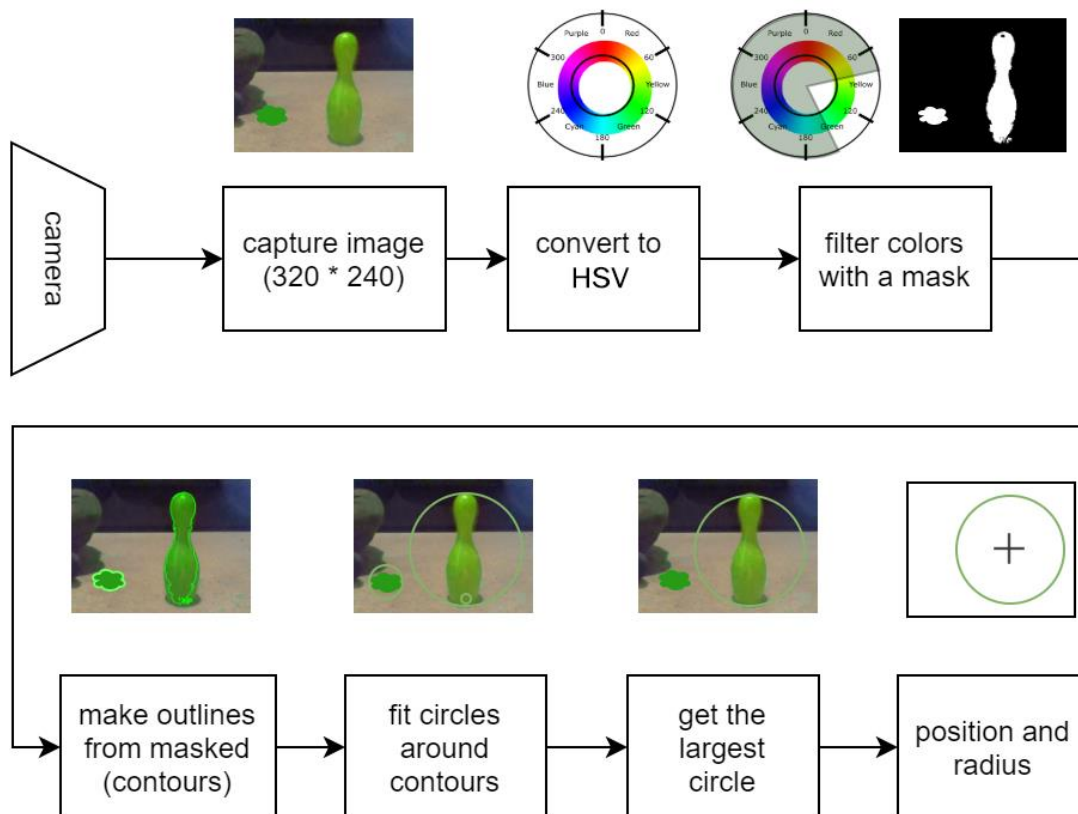
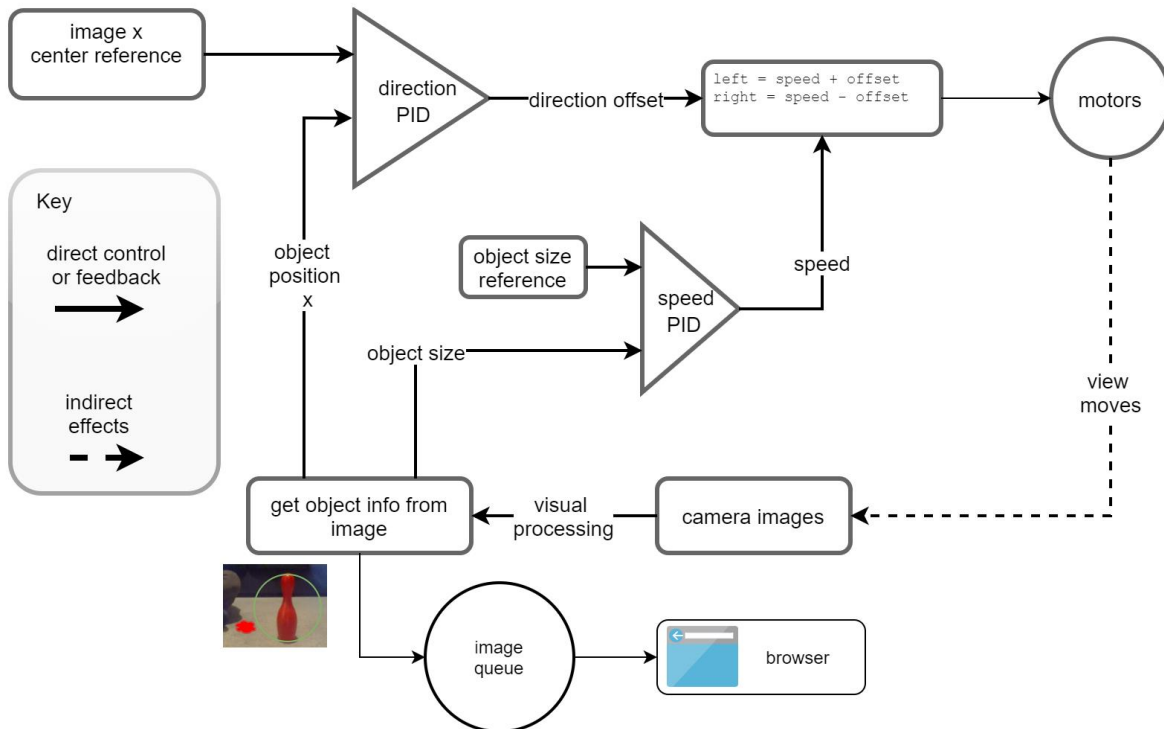




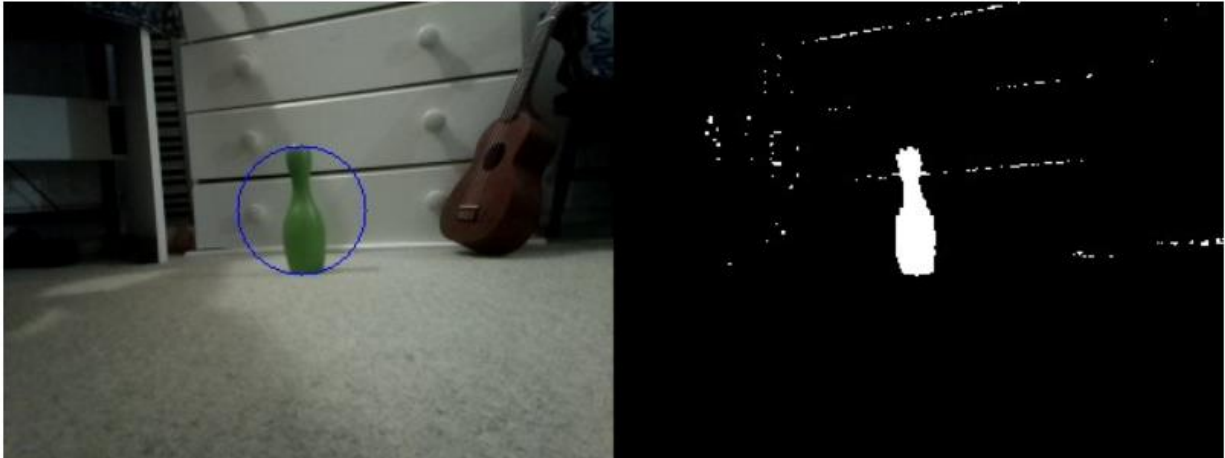


Robot Image Server



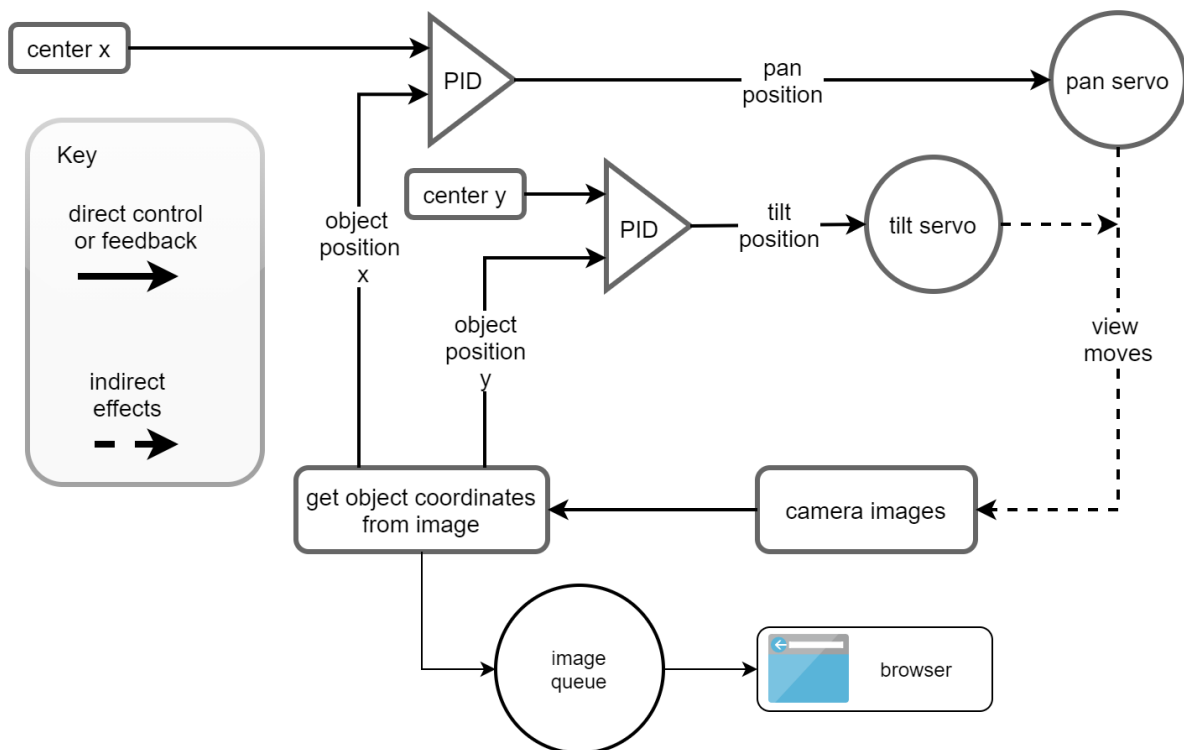
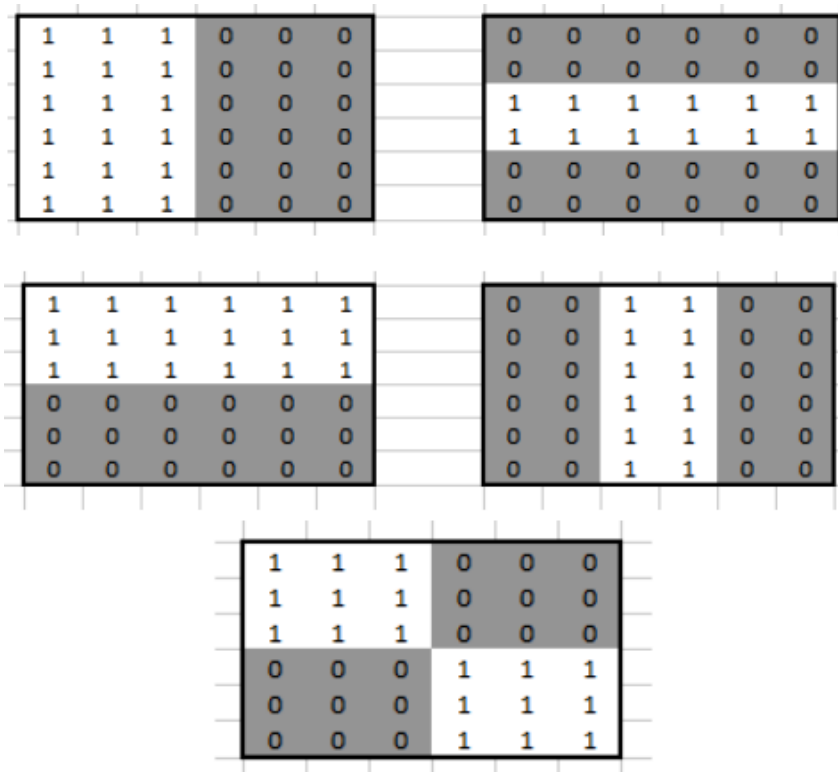


Robot Image Server



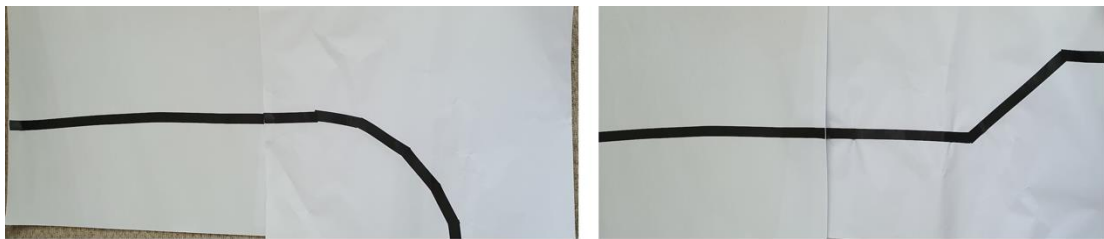
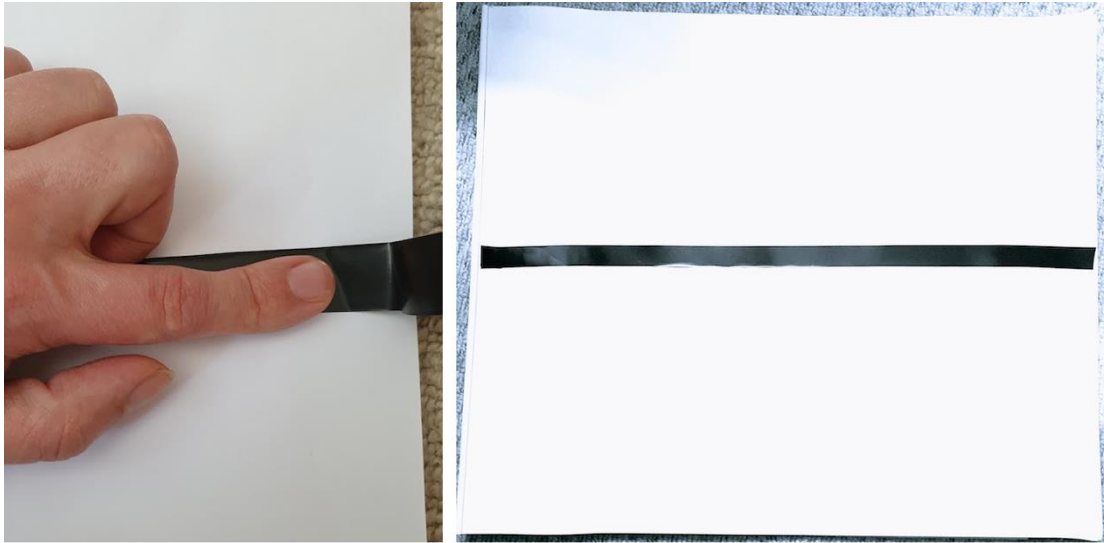
[Start](#) [Stop](#)
[Exit](#)

Image									Integral Image								
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9	9	5	5	5	5	9	9		81	119	152	186	220	253	291	372	



Chapter 14: Line-Following with a Camera in Python





① None



② Small



③ Large



④ Large Negative

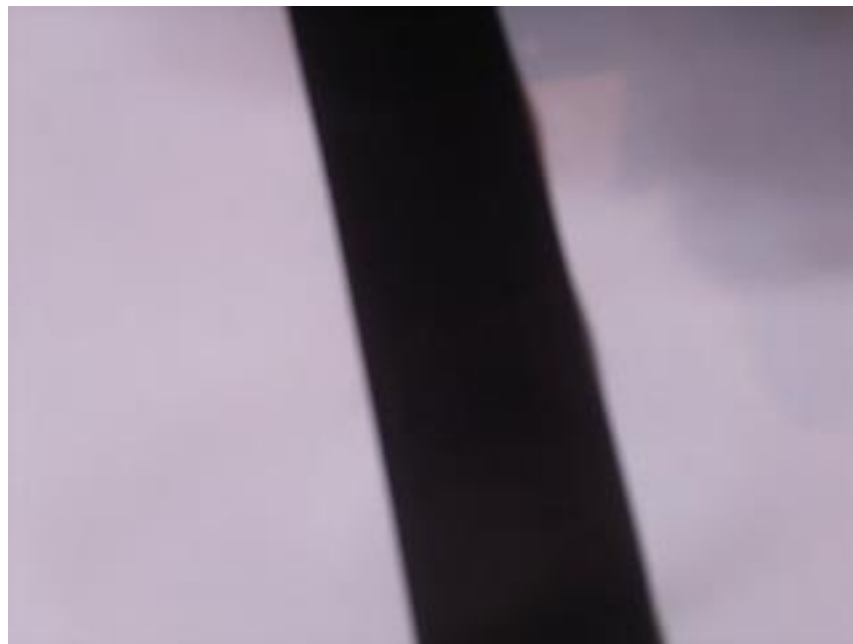
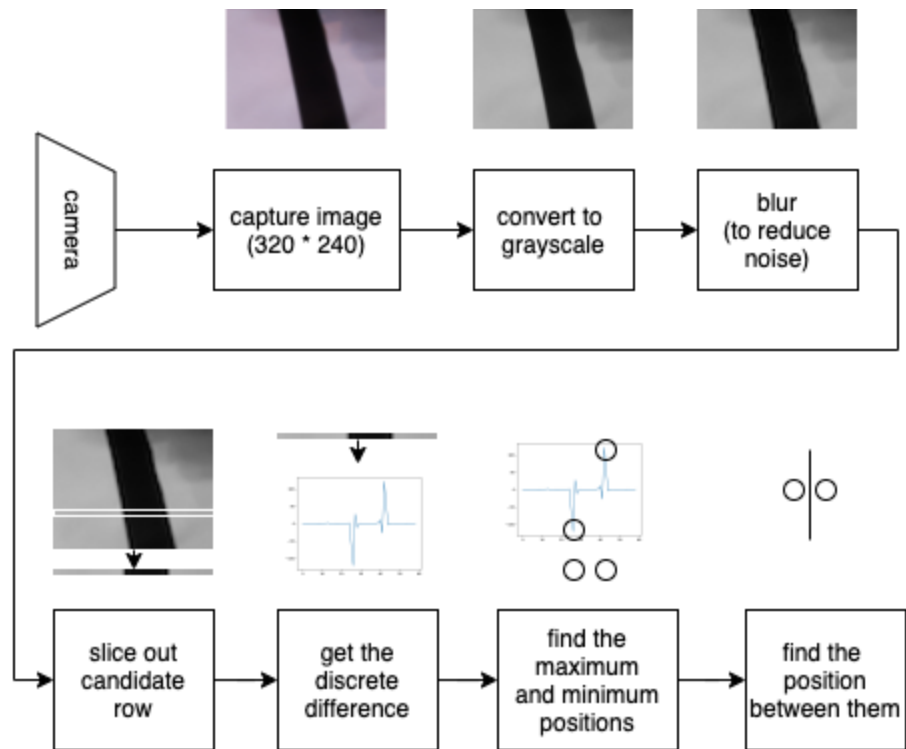


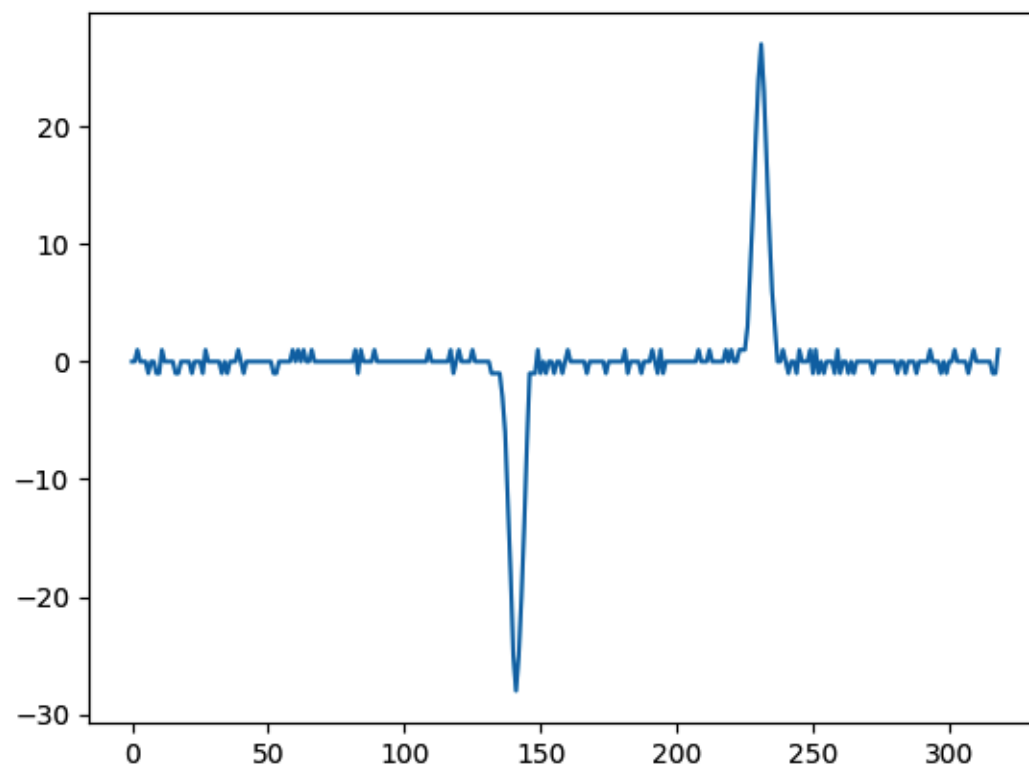
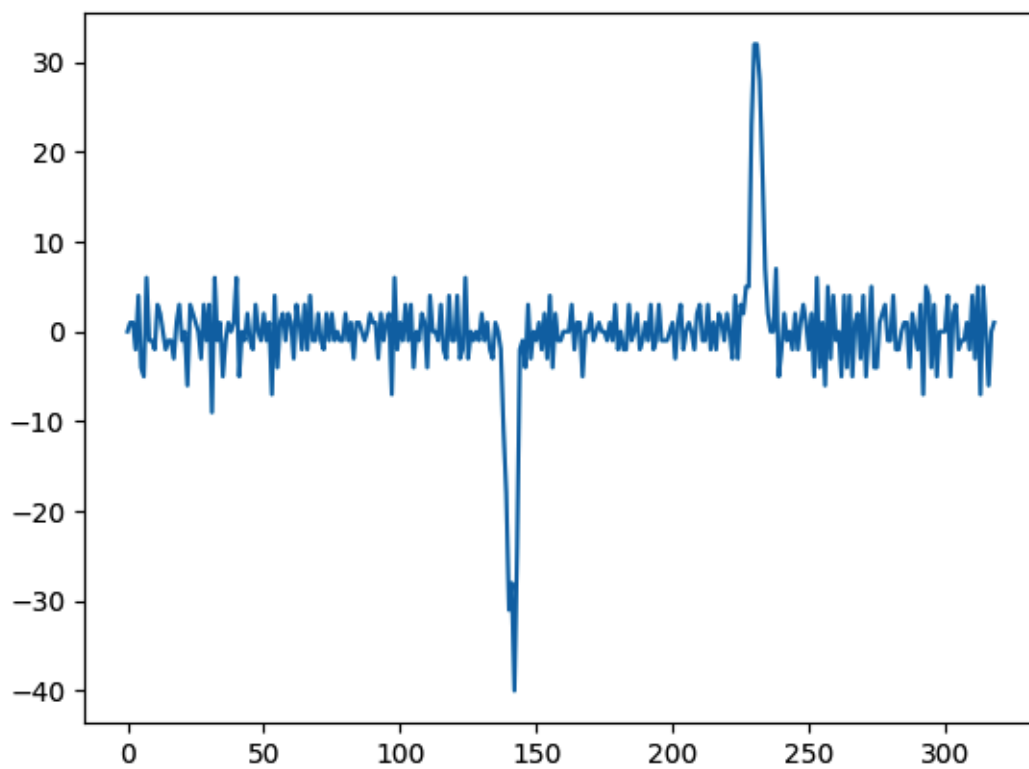
⑤ None

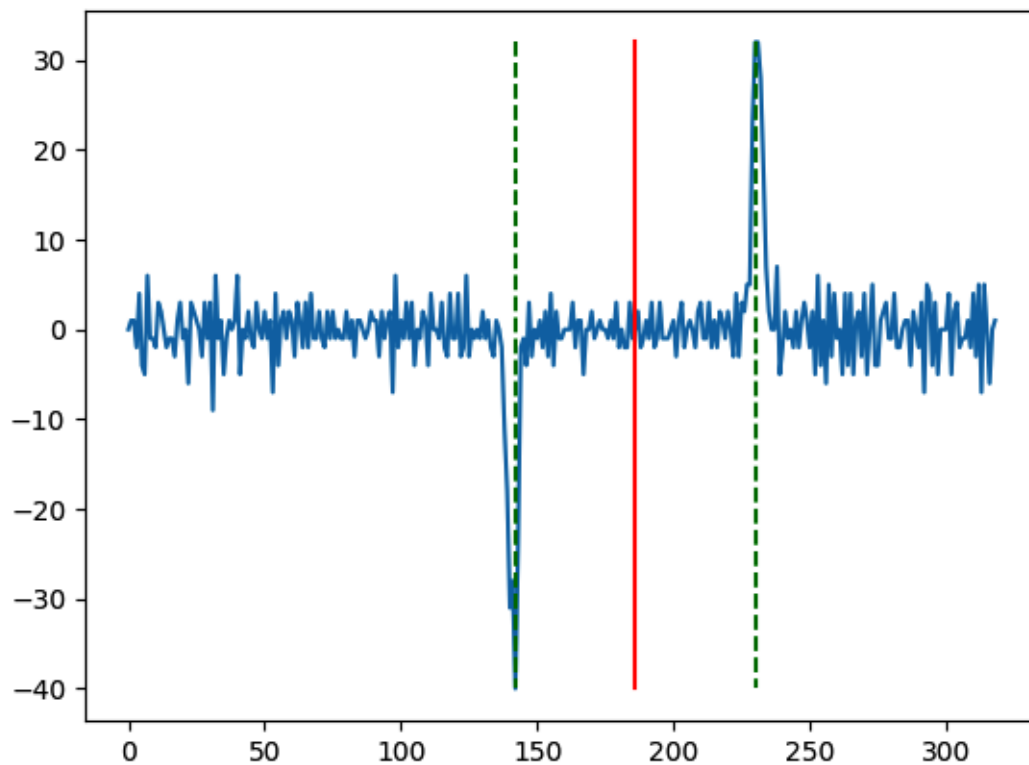


⑥ Small Negative

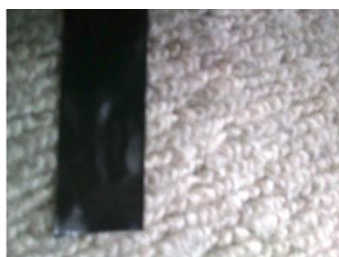




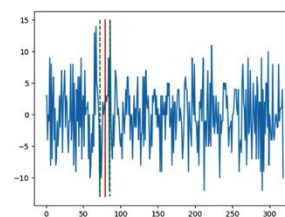
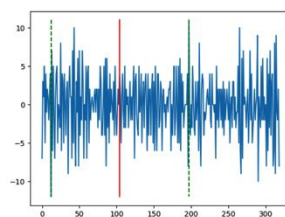
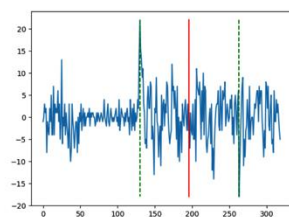




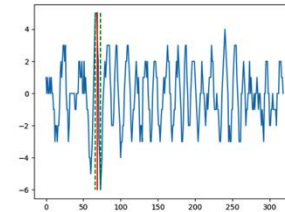
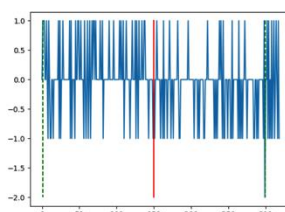
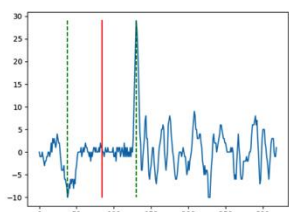
Original

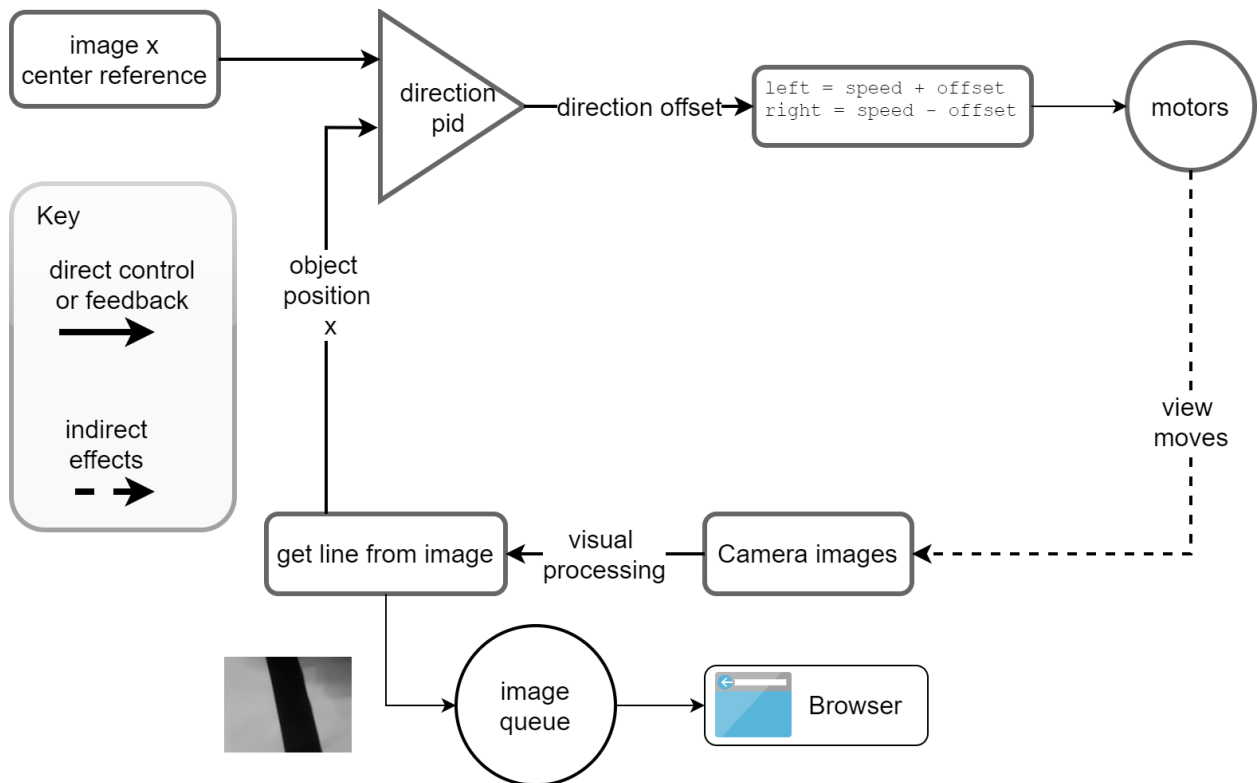
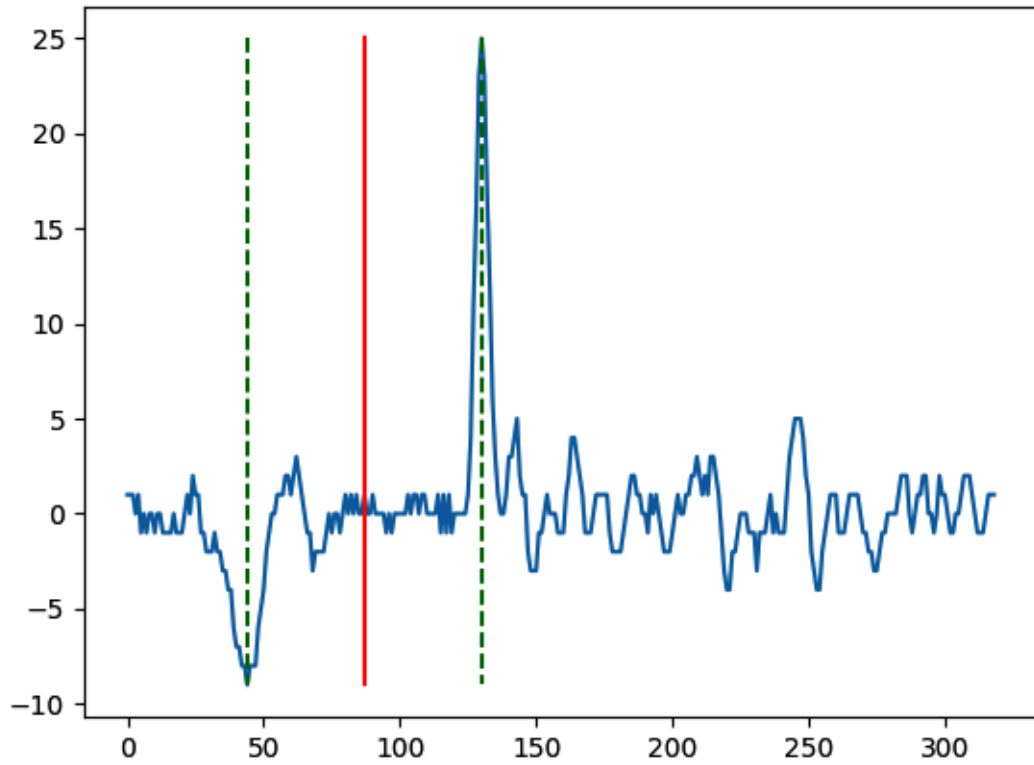


Diff Graph

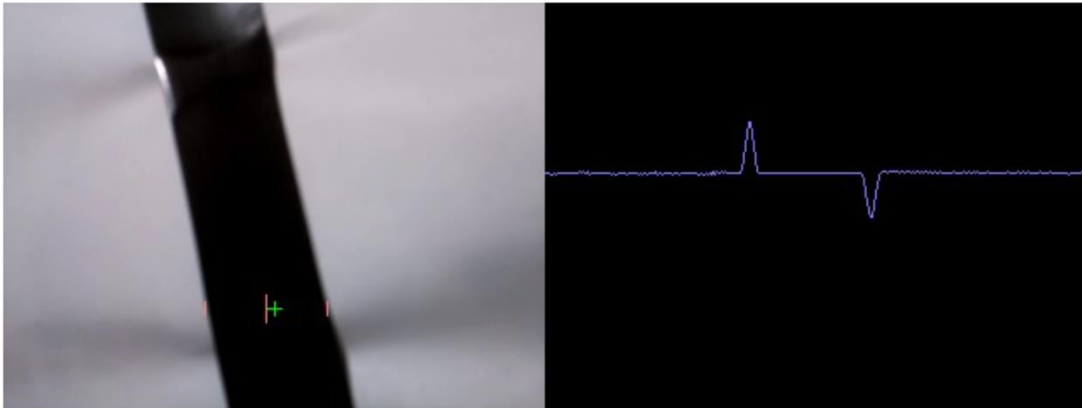


With Blur



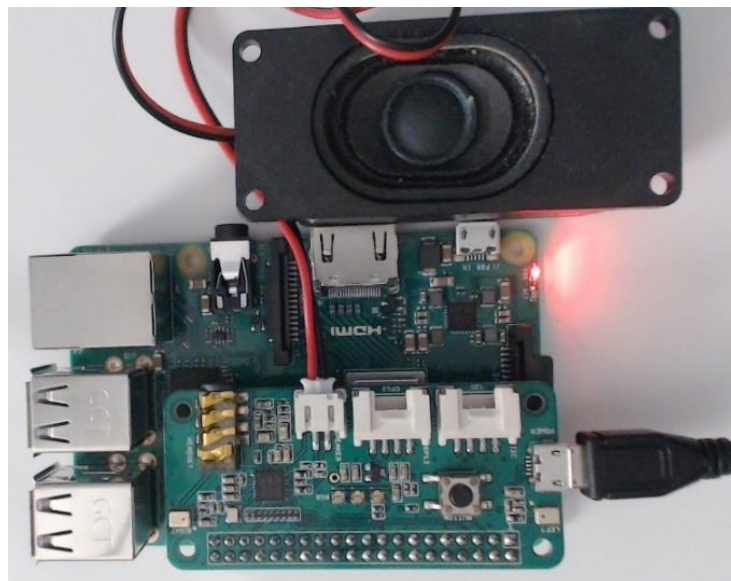
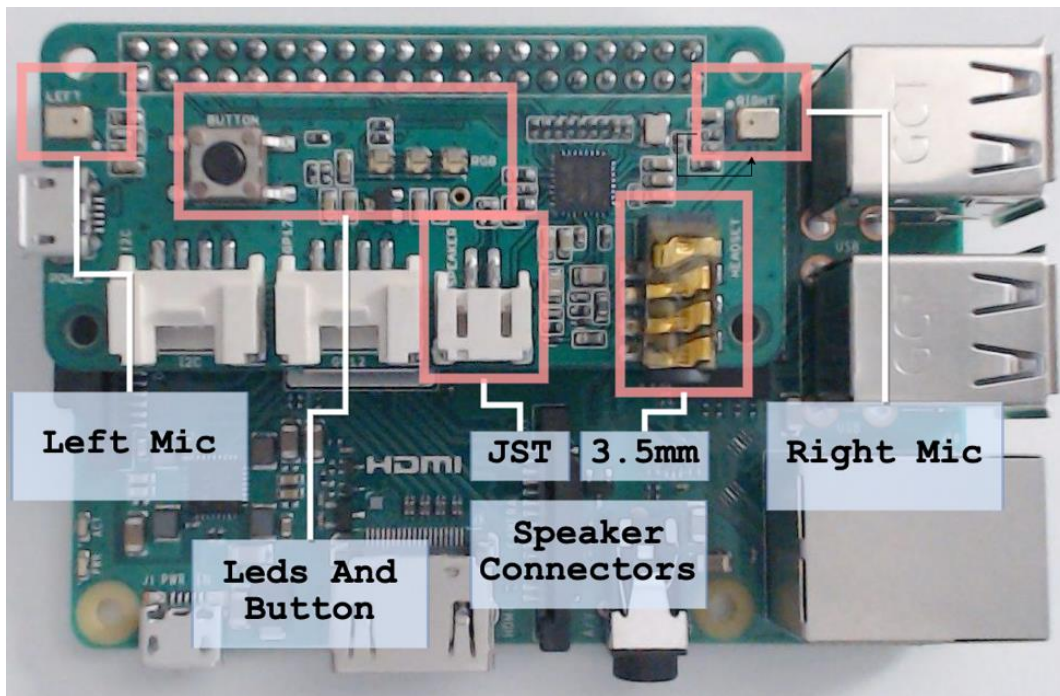


Robot Image Server



[Start](#) [Stop](#)
[Exit](#)

Chapter 15: Voice Communication with a Robot Using Mycroft



```

Log Output:                                0-10 of 10
===== mycroft-core 20.8.0 =====
Establishing Mycroft Messagebus connection...
Connected to Messagebus!
~~~~oft.session:get:74 | New Session Start: 2c486244-2370-4032-bea2-1f53c81384fa
~~~~0 | 745 | __main__:handle_wakeword:67 | Wakeword Detected: hey mycroft
~~~~nd/start_listening.wav' : Signed 16 bit Little Endian, Rate 48000 Hz, Stereo
~~~~24 | INFO | 745 | __main__:handle_record_begin:37 | Begin Recording...
~~~~53.807 | INFO | 745 | __main__:handle_record_end:45 | End Recording...
~~~~45 | __main__:handle_utterance:72 | Utterance: ['what is the weather today']
12:01:54.954 | INFO | 739 | WeatherSkill | Forecast for now
^--- NEWEST ---^

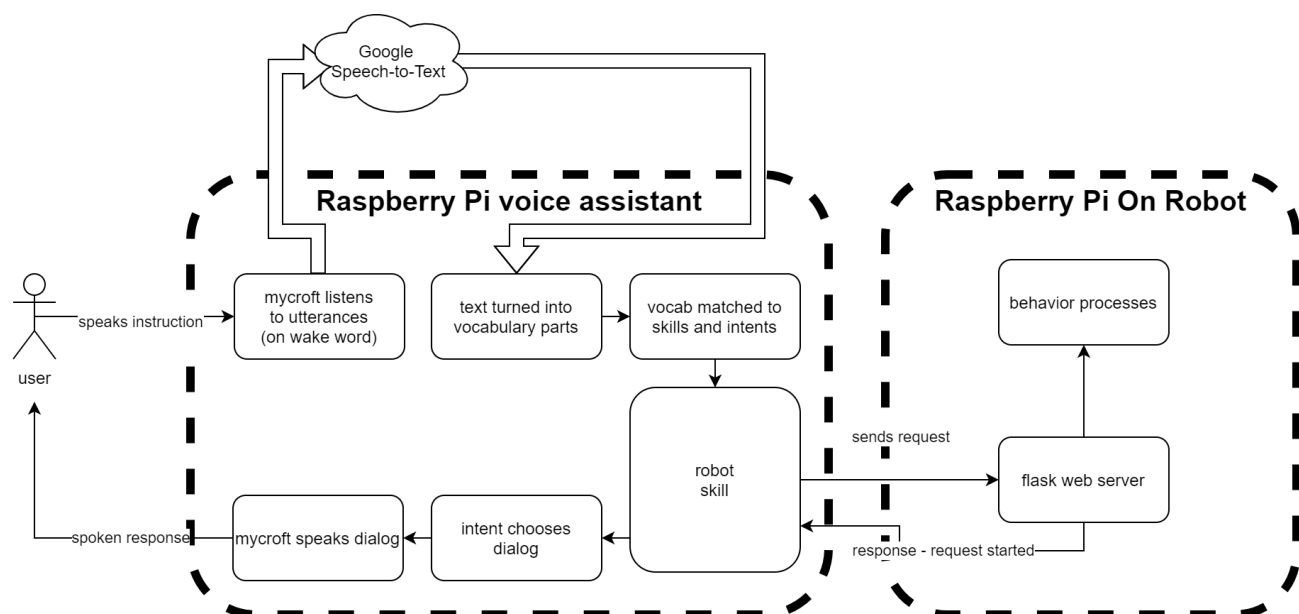
History =====
what is the weather today
>> It's currently a clear sky and 25
degrees.
>> Today's forecast is for a high of
27 and a low of 15.

Log Output Legend ===== Mic Level ===
DEBUG output
skills.log, other
voice.log

--- 744.00

Input (':' for command, Ctrl+C to quit) =====399 *
>

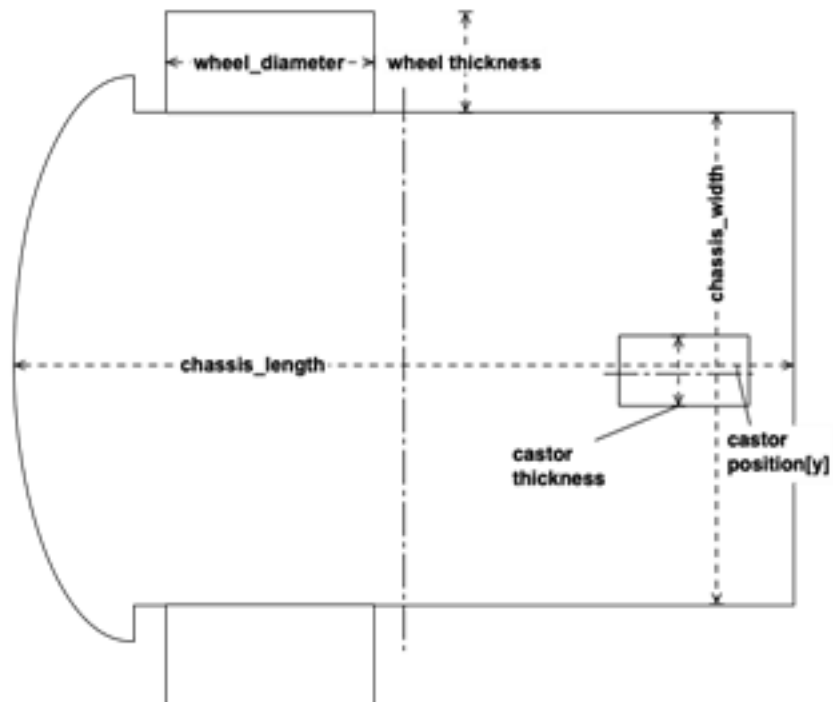
```



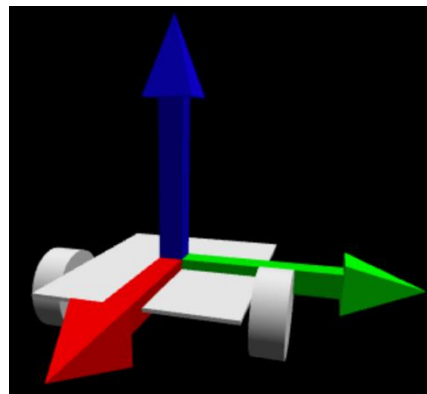
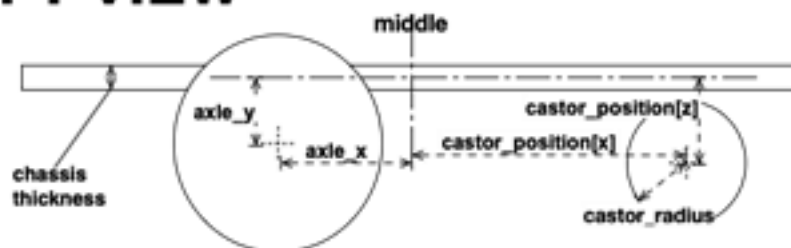
- ▼  my-robot-skill
 - ▼  dialog
 - ▼  en-us
 -  Robot.dialog
 -  TestingRainbow.dialog
 -  UnableToReach.dialog
 - ▼  vocab
 - ▼  en-us
 -  robot.voc
 -  TestRainbow.voc
 -  __init__.py
 -  requirements.txt
 -  settings.json

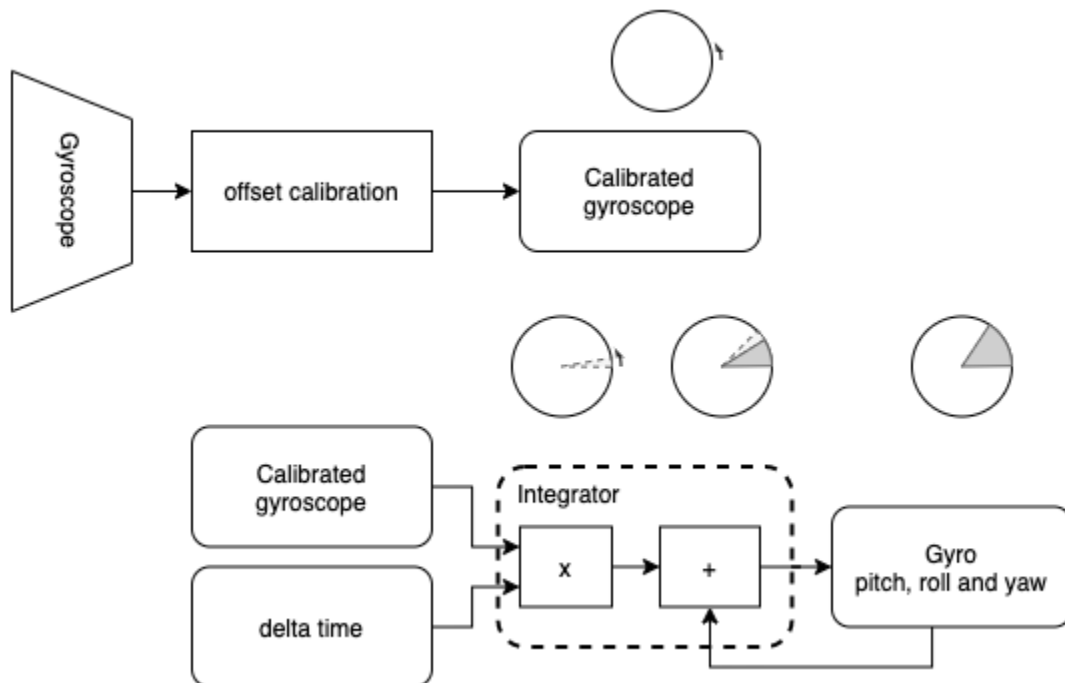
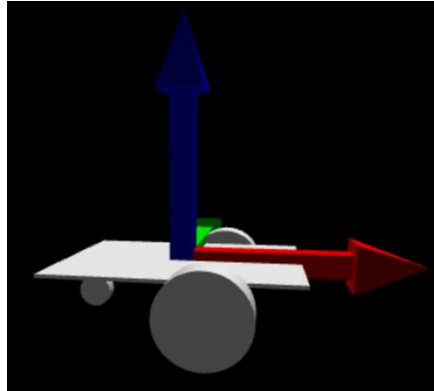
Chapter 16: Diving Deeper with the IMU

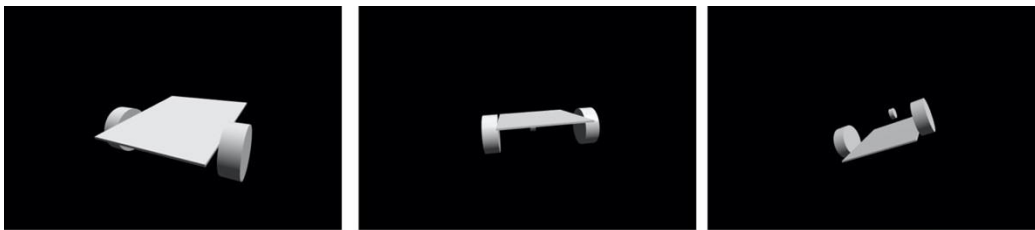
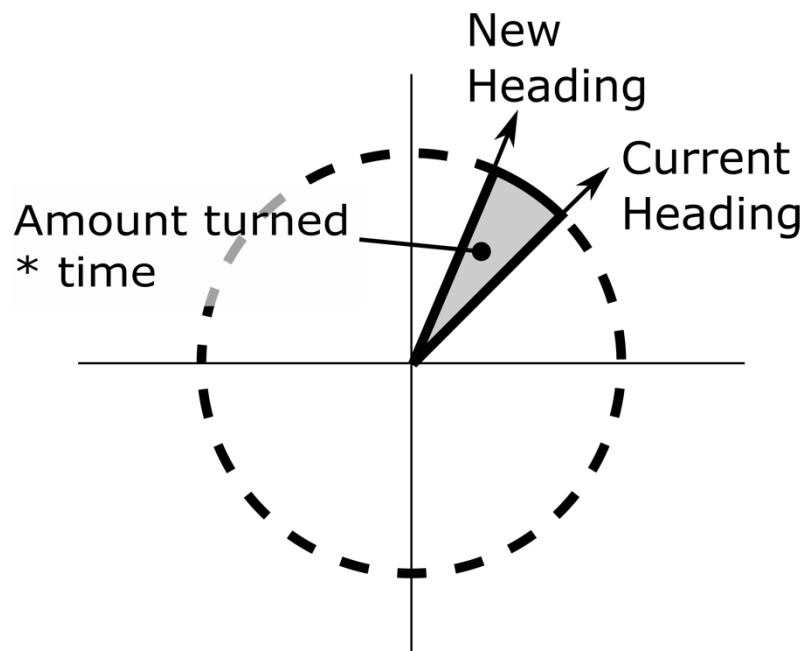
TOP VIEW

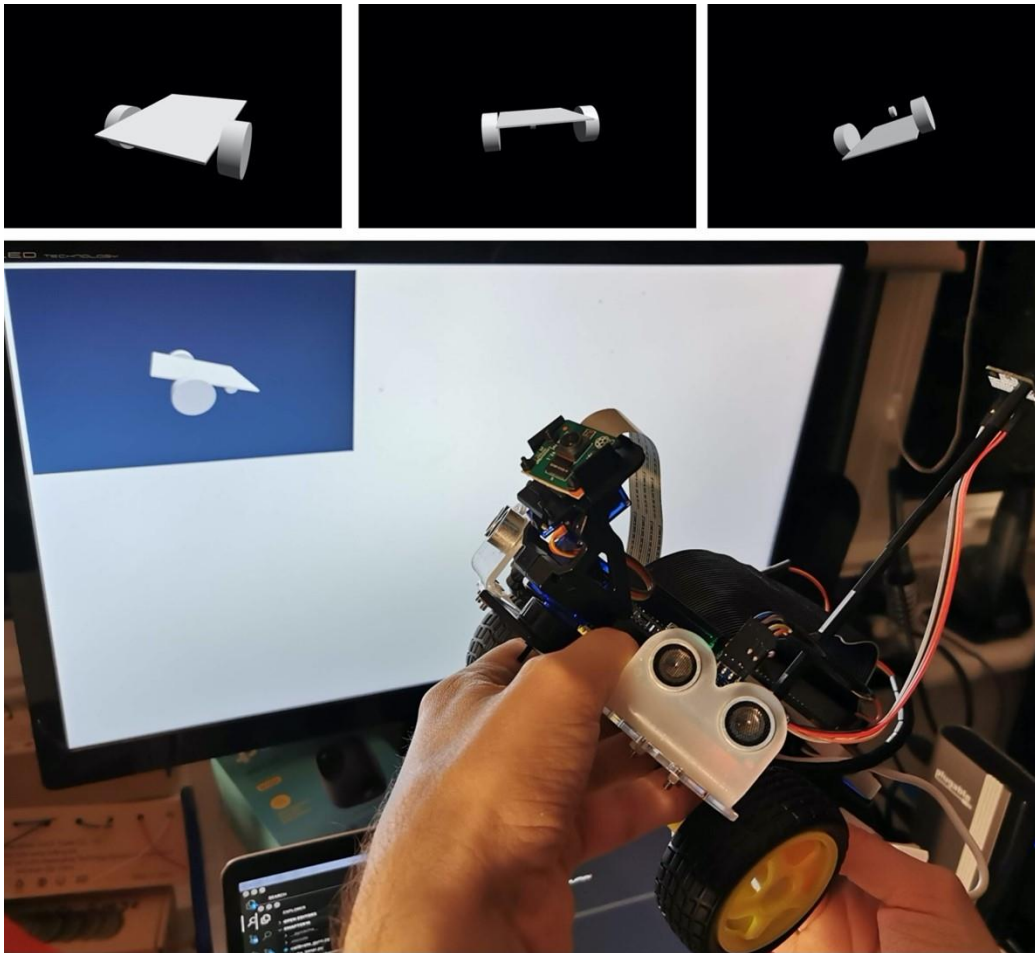


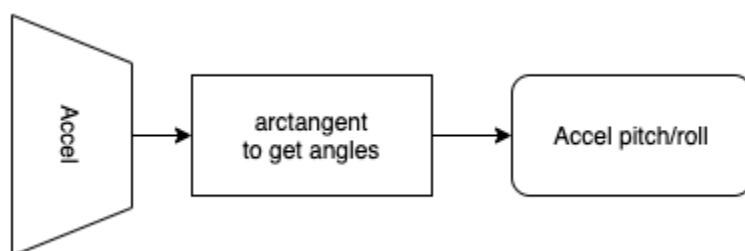
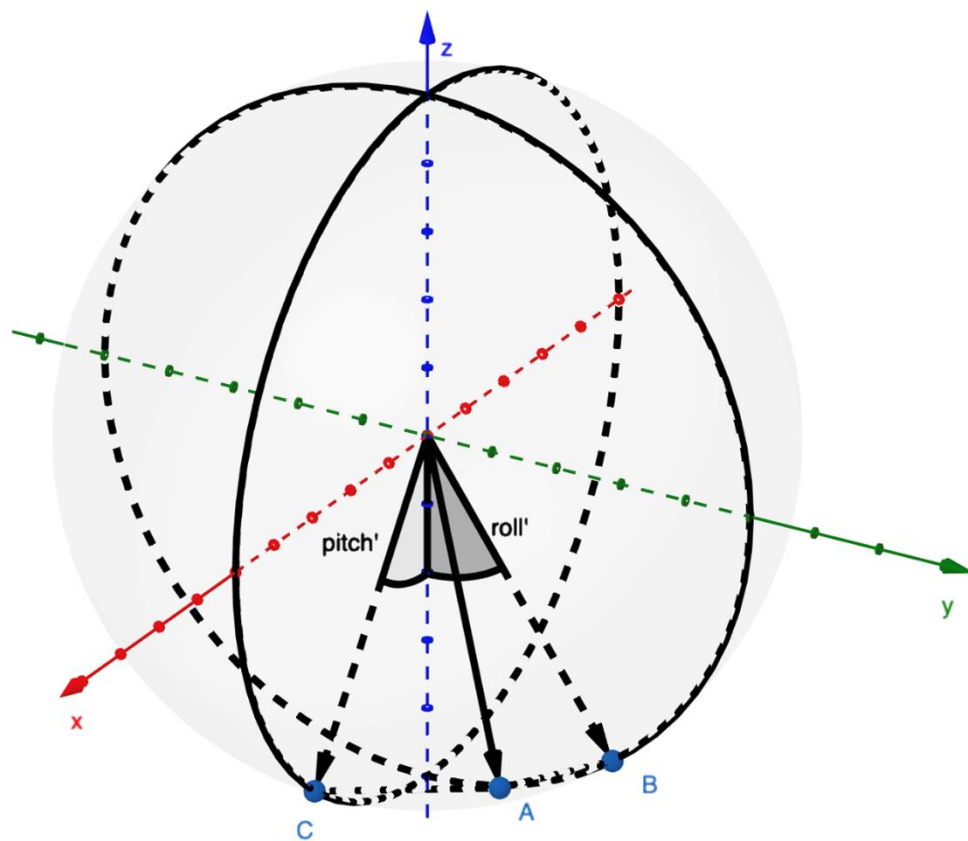
LEFT VIEW

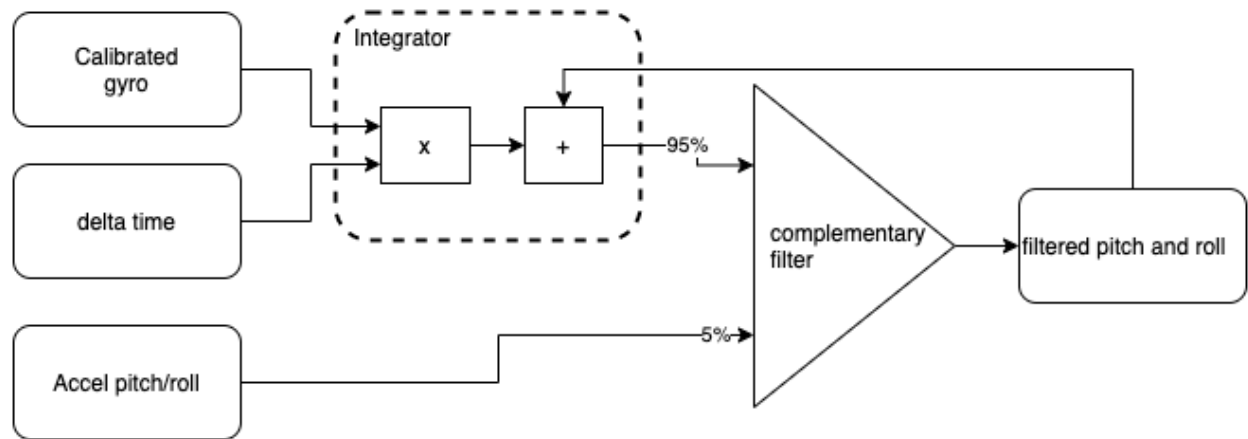
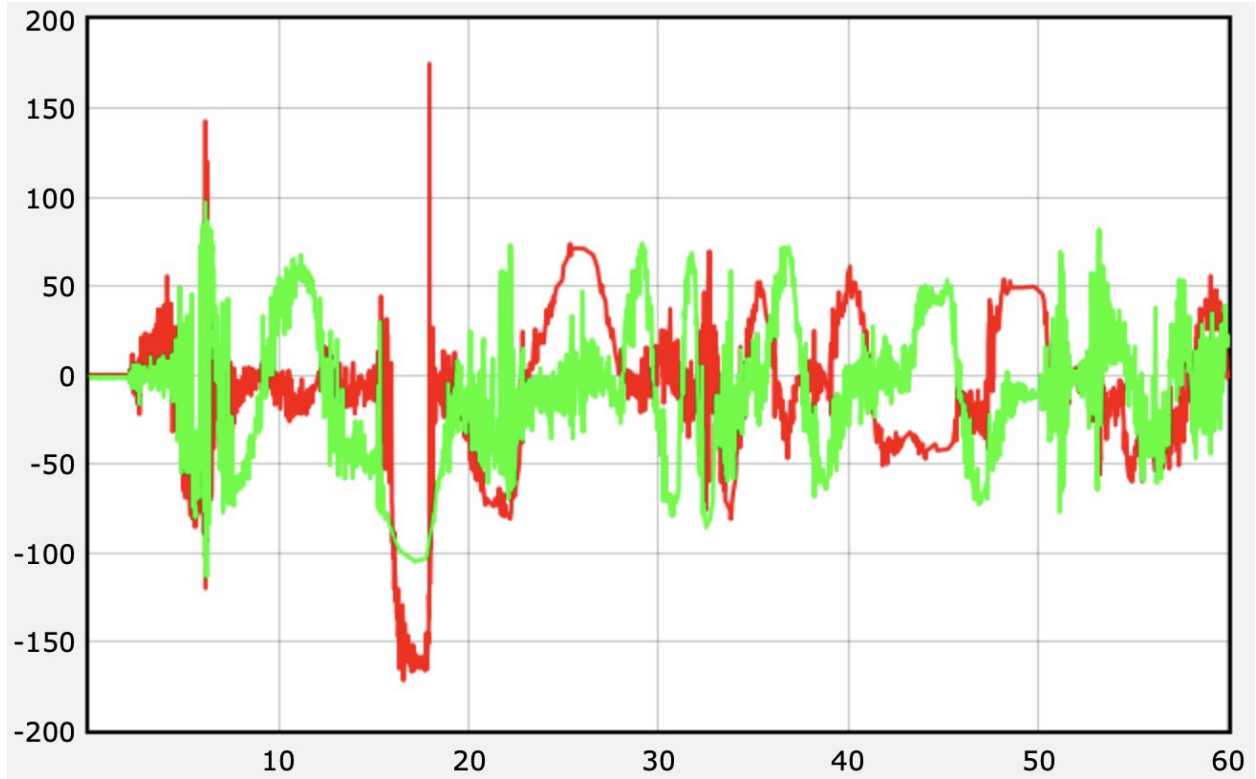


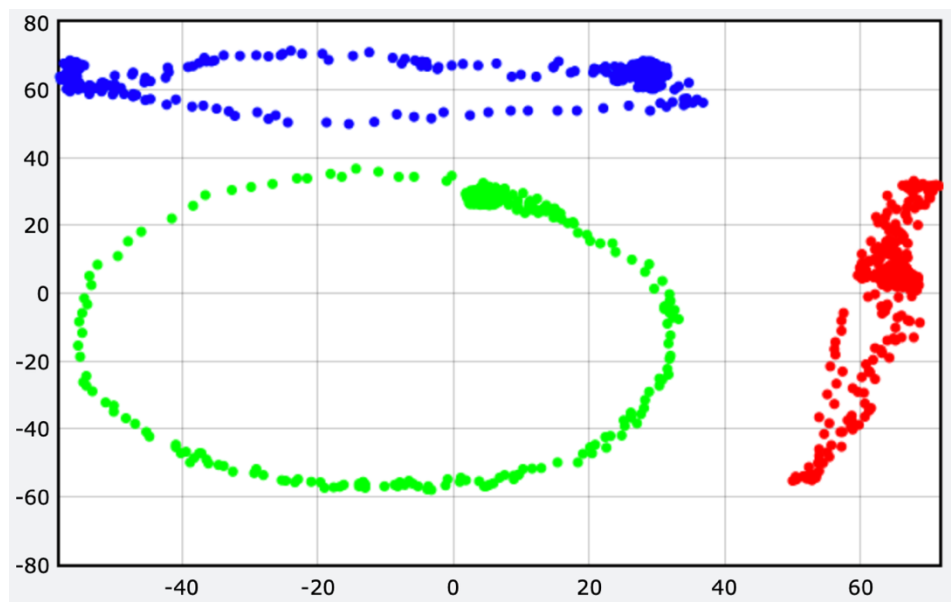
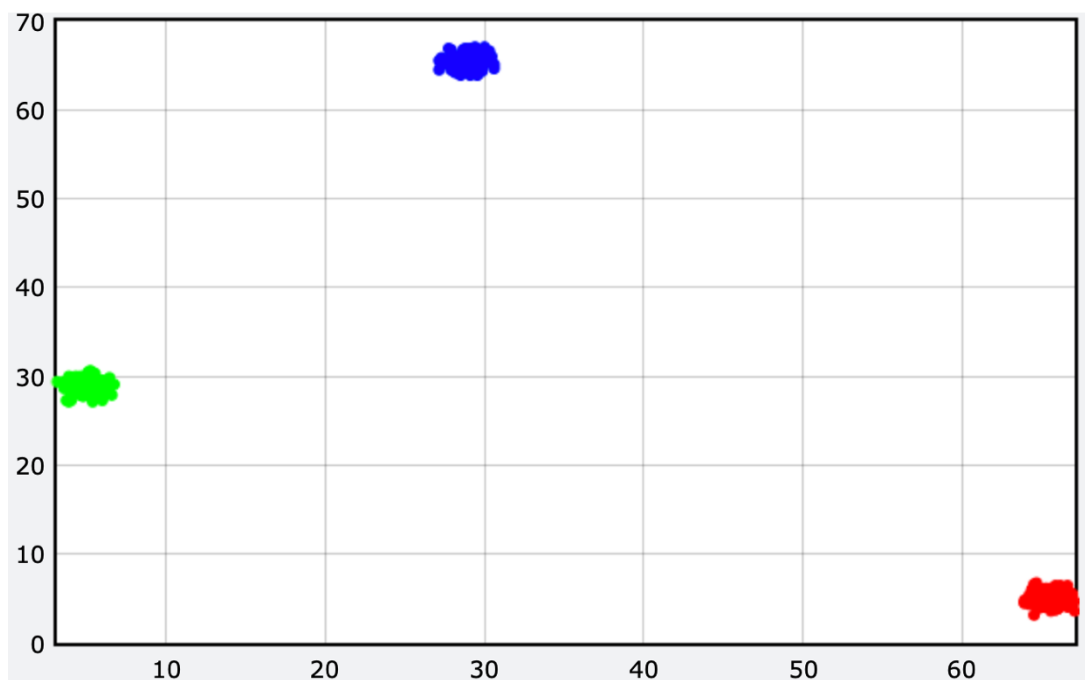


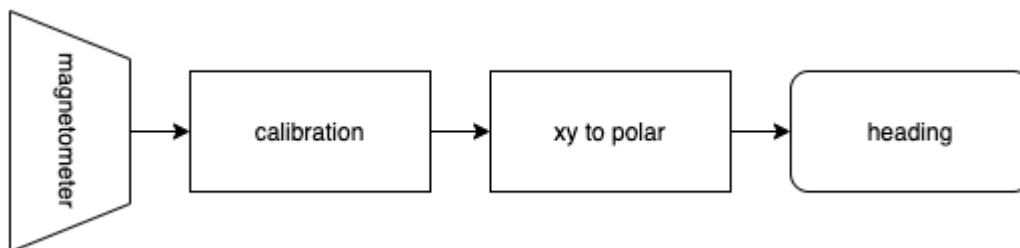
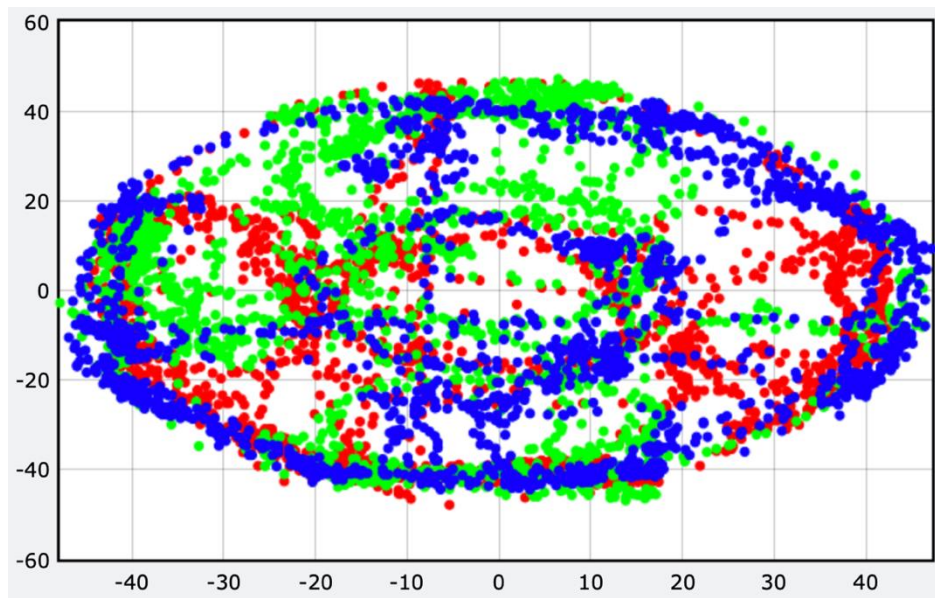
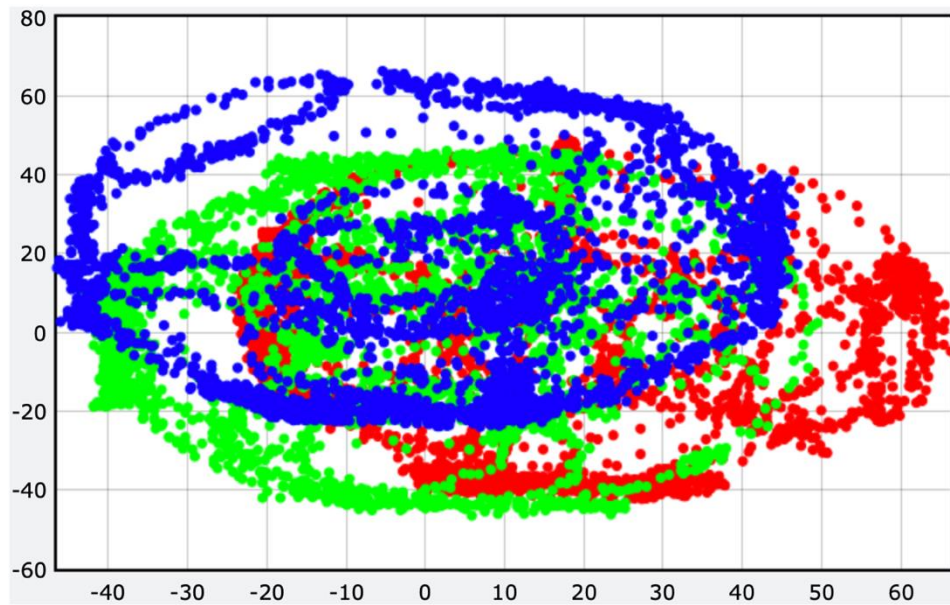


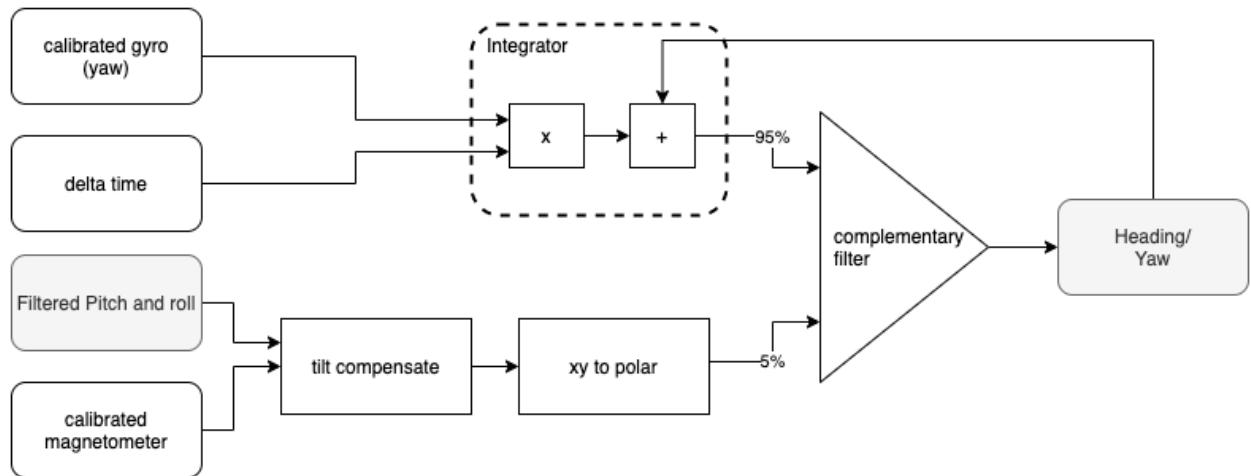
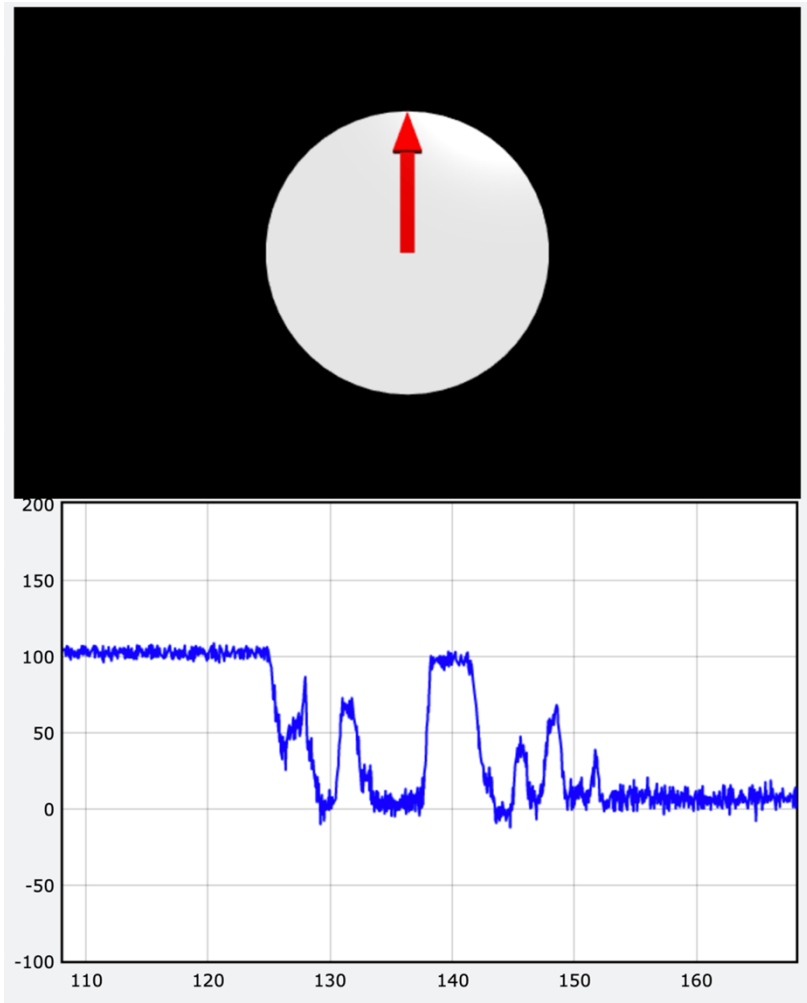


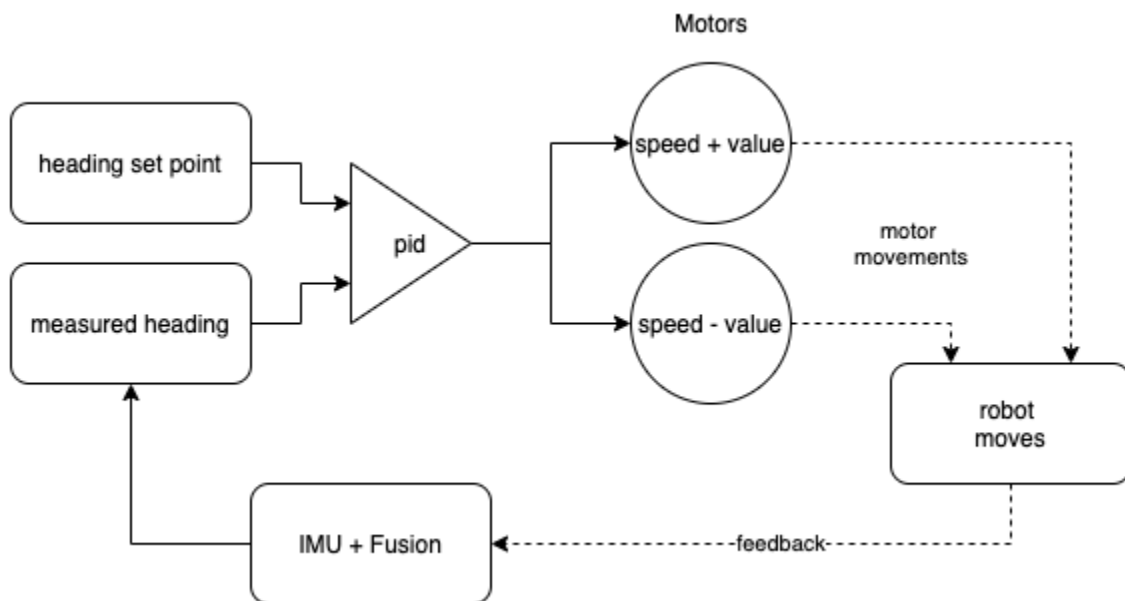
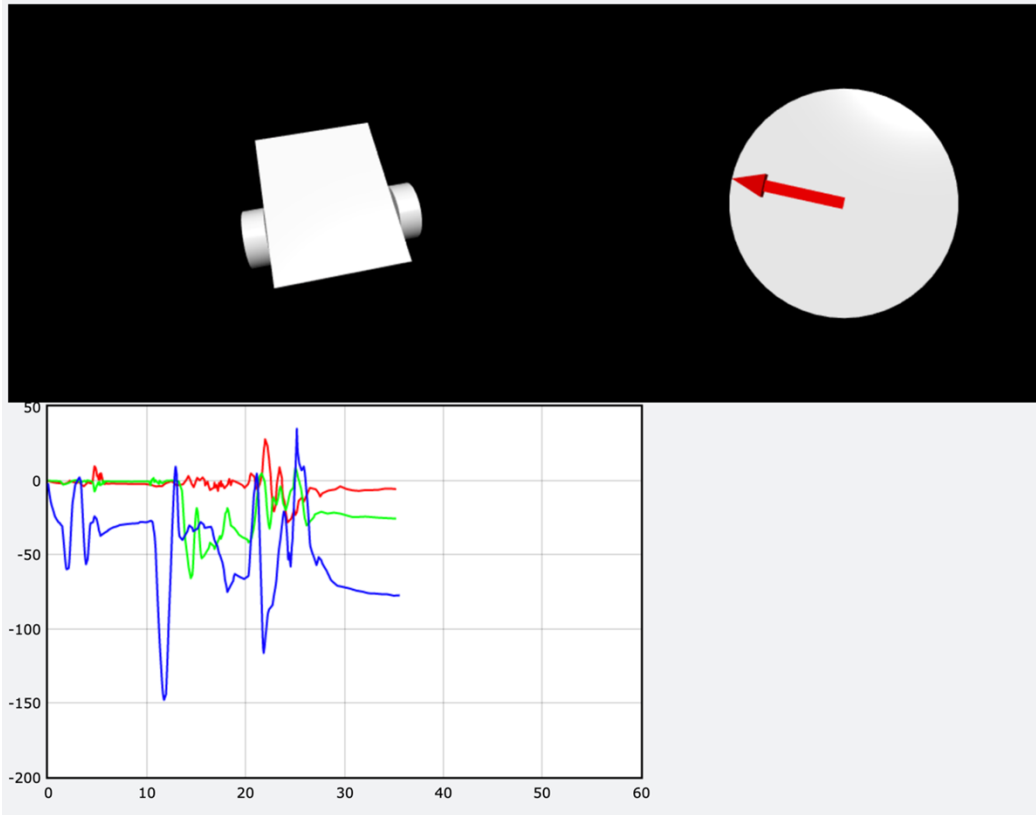




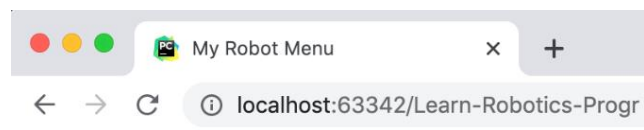
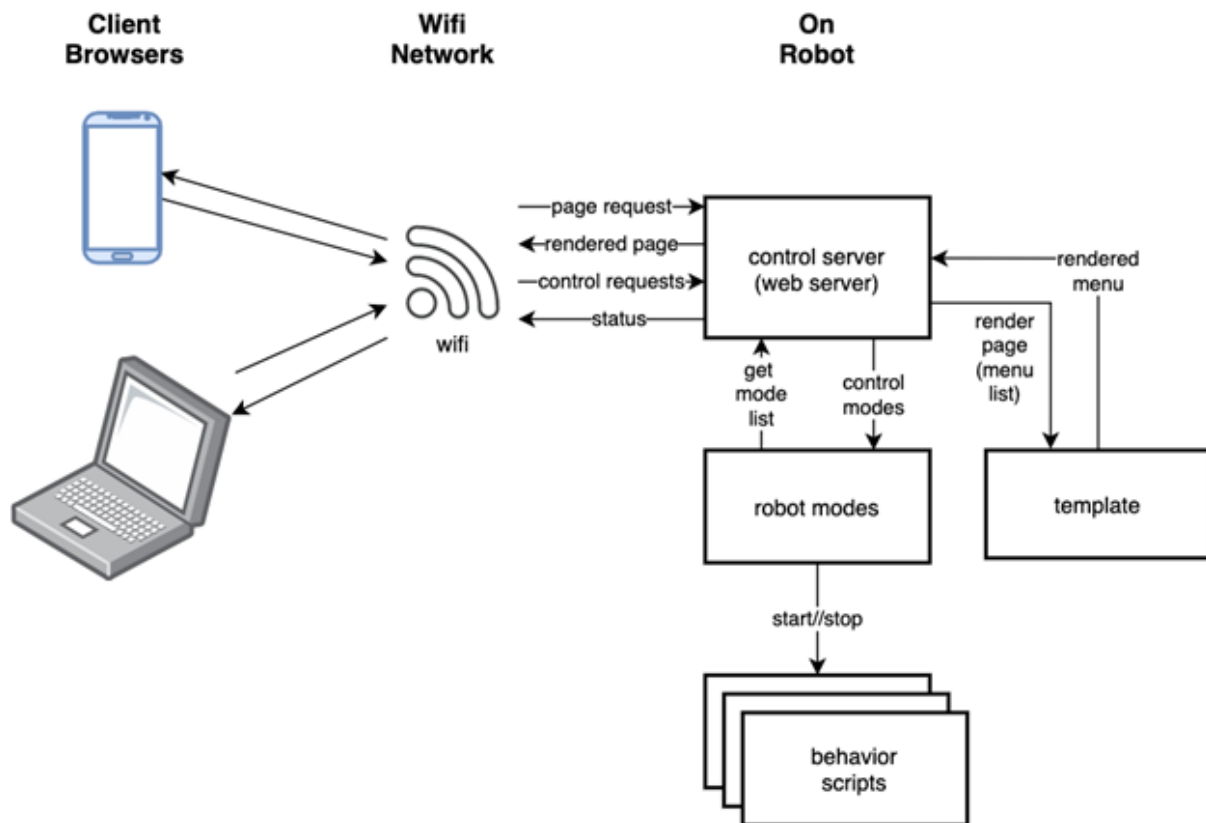






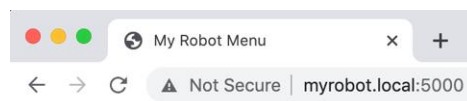


Chapter 17: Controlling the Robot with a Phone and Python



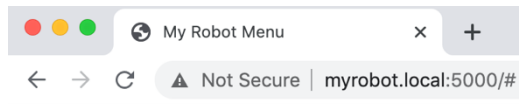
My Robot Menu

- ```
{% for item in menu %}
```
- [{{ item.text }}](#)
- ```
{% endfor %}
```
- [Stop](#)



My Robot Menu

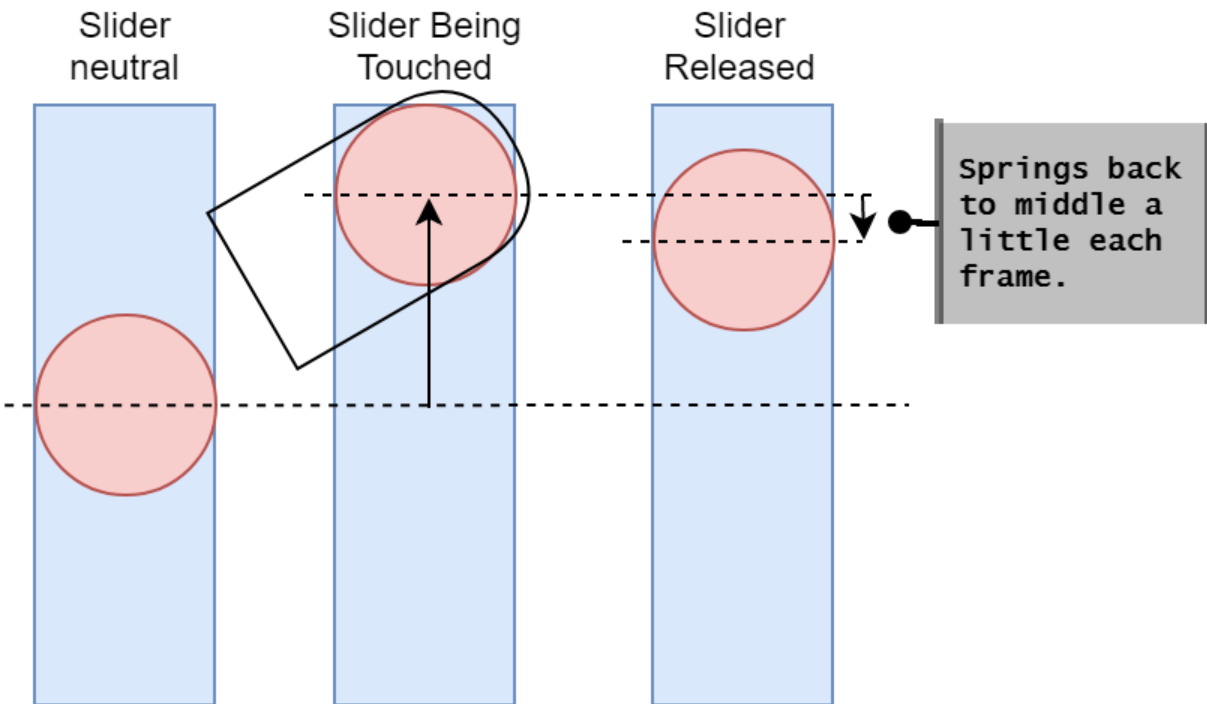
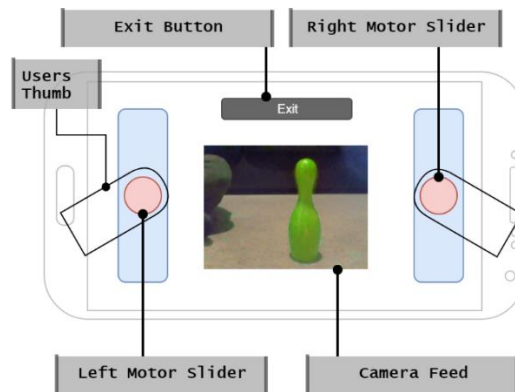
- [Avoid Behavior](#)
- [Circle Head](#)
- [Test LEDs](#)
- [LED Rainbow](#)
- [Line Following](#)
- [Drive In A Line](#)
- [Drive North](#)
- [Stop](#)



My Robot Menu

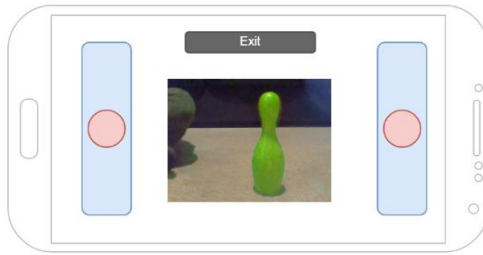
Stopped

- [Avoid Behavior](#)
- [Circle Head](#)
- [Test LEDs](#)
- [LED Rainbow](#)
- [Line Following](#)
- [Drive In A Line](#)
- [Drive North](#)
- [Stop](#)

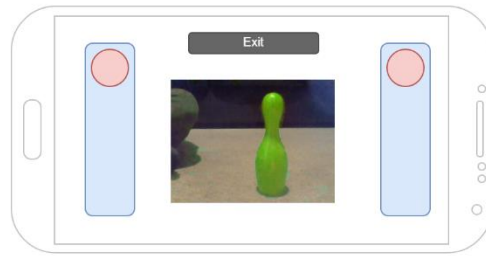




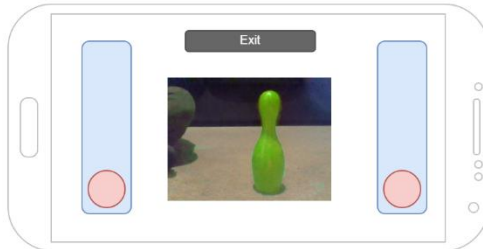
Stopped



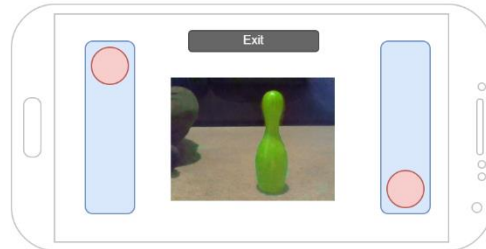
Forward



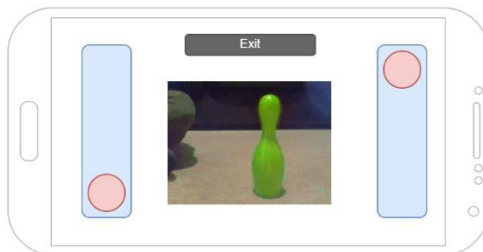
Backwards



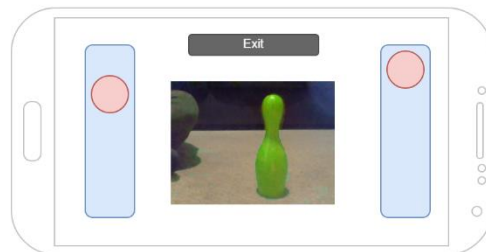
Spin Right

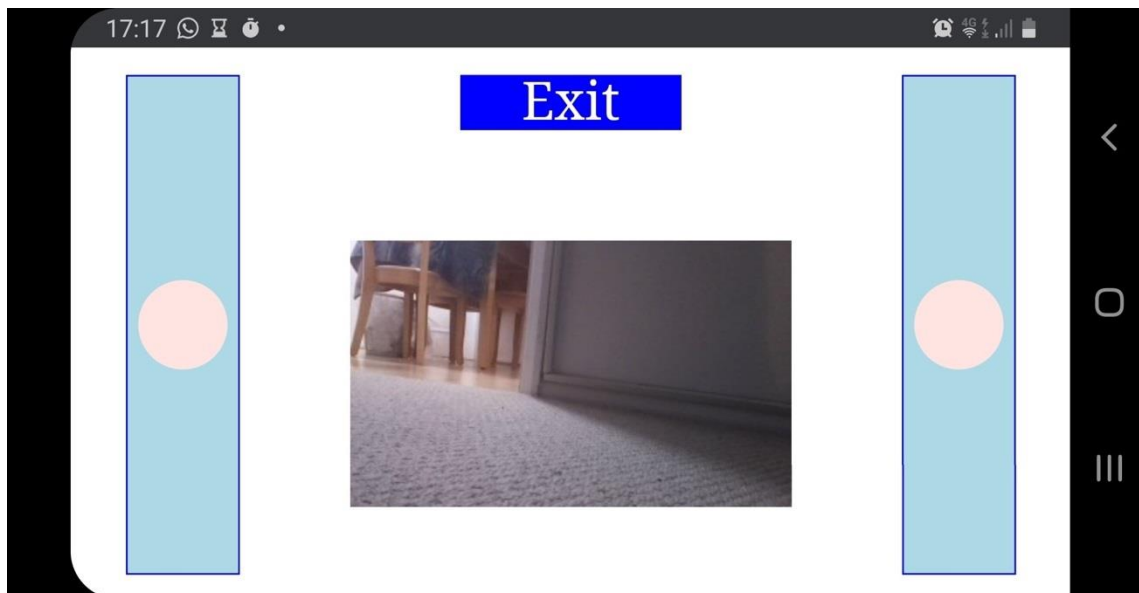
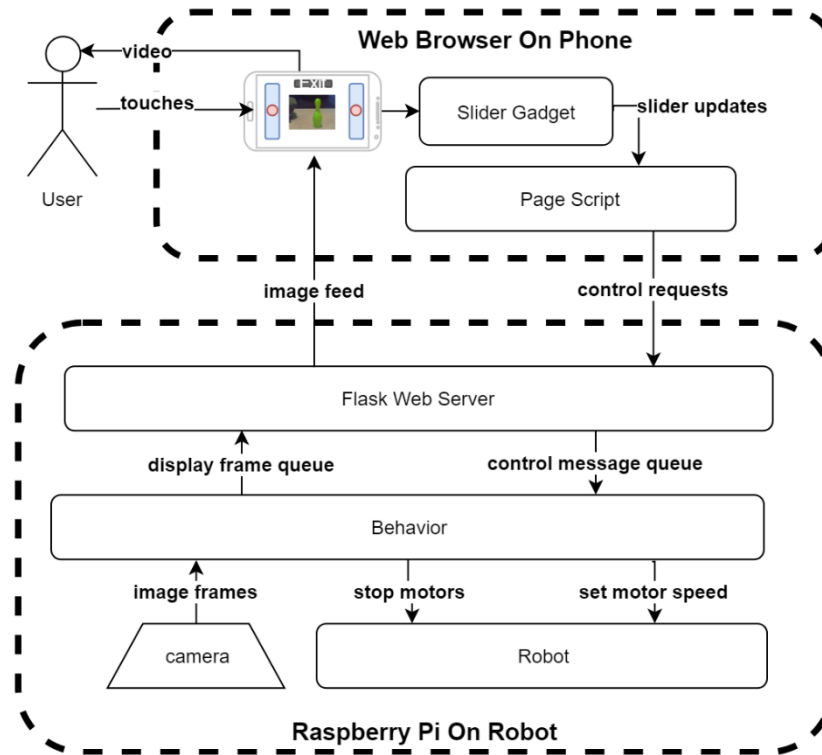


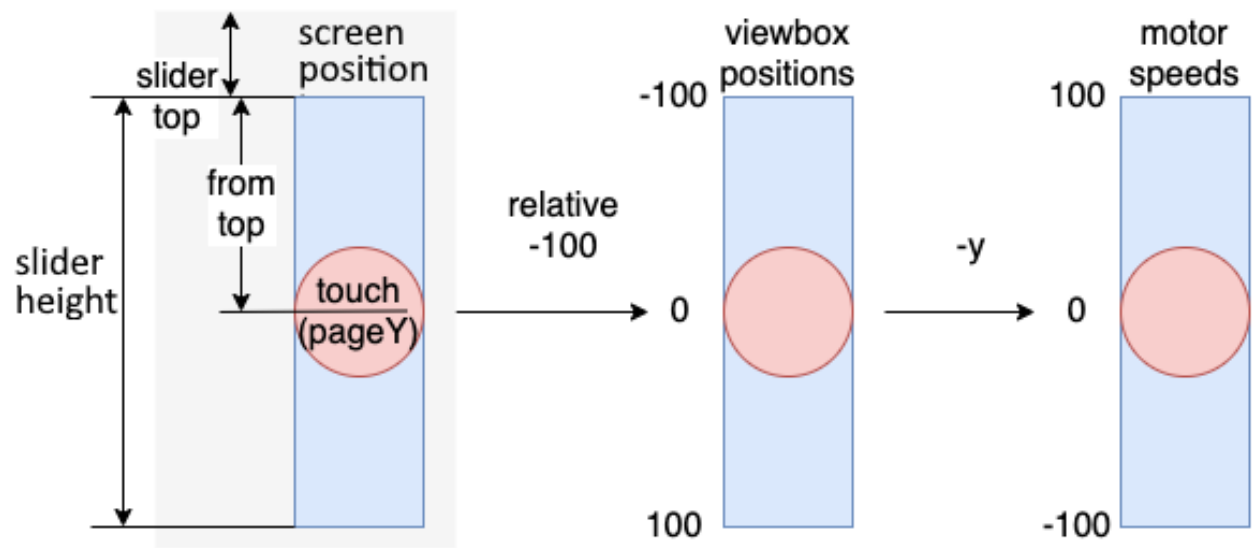
Spin Left



Forward And Left







Chapter 18: Taking Your Robot Programming Skills Further

No Images

Chapter 19: Planning Your Next Robot Project – Putting It All Together

