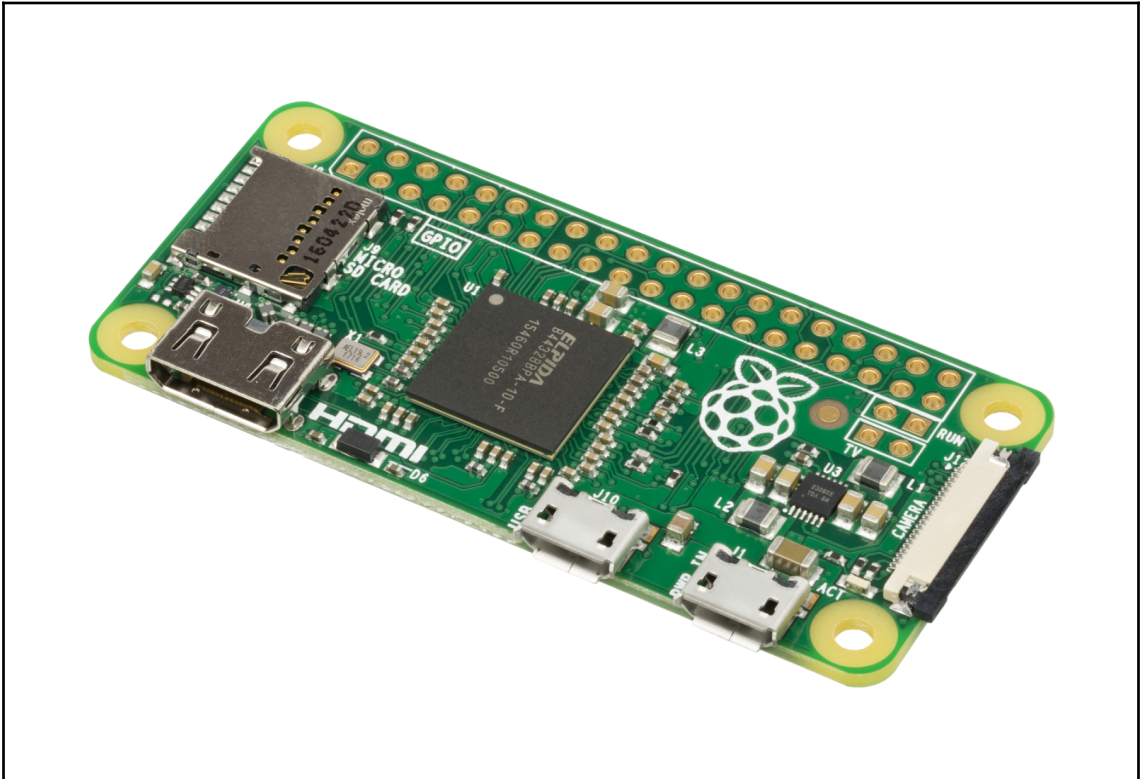
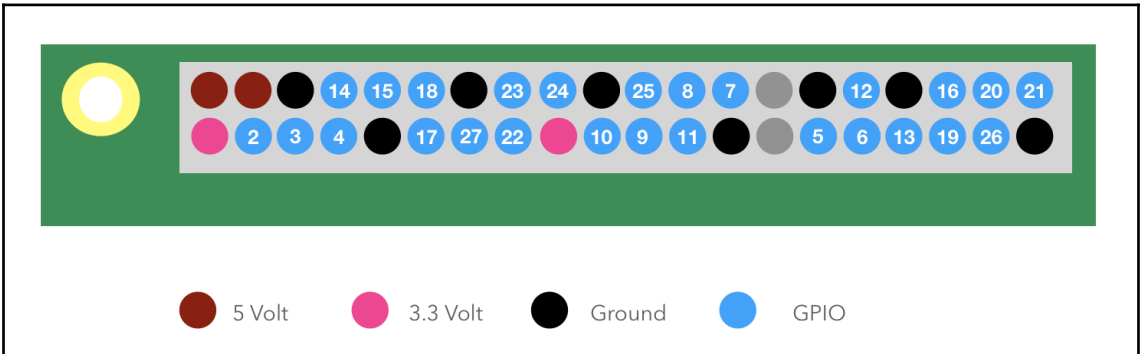
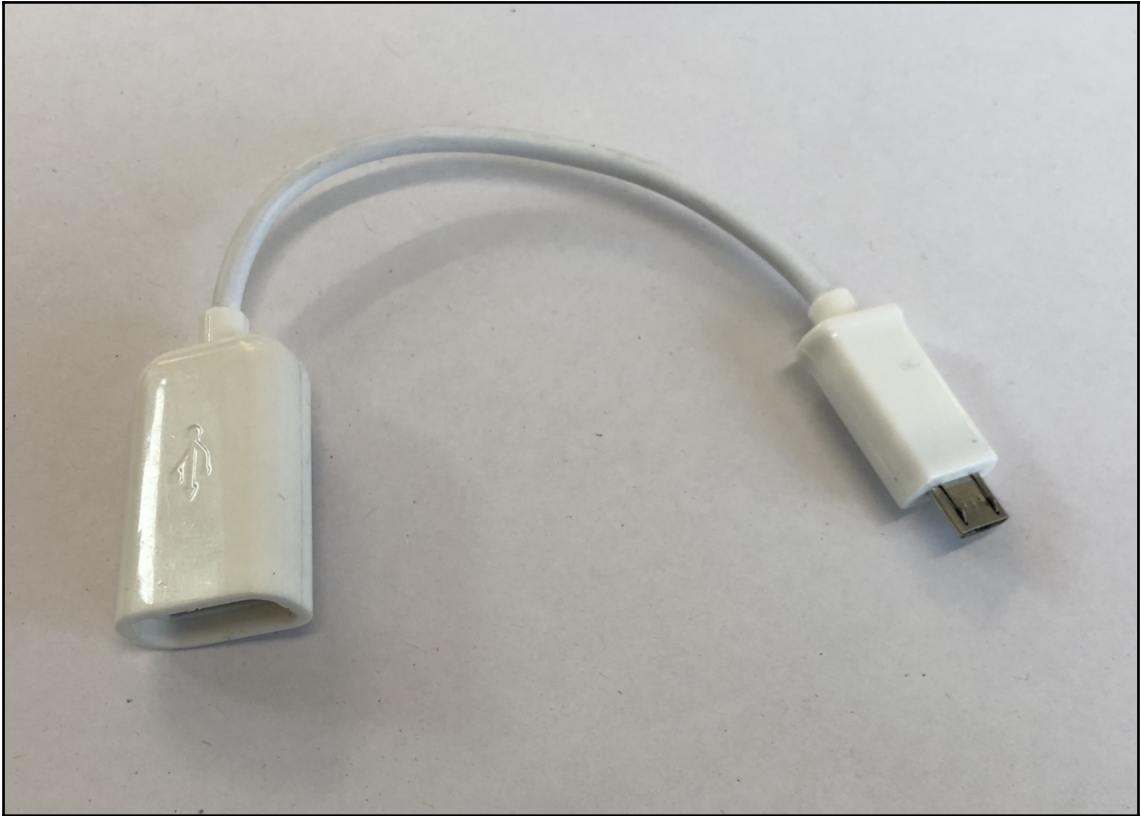


Chapter 1: Robotics 101





`GPIO.setmode(GPIO.BCM)`



We are telling that the function after it is by the library of GPIO, or in other words by RPi.GPIO



This is command to set the configuration



This is telling in which fashion it will be configured. According to GPIO.BCM it will be configured as per defined by Broadcom

`GPIO.setup(23,GPIO.OUT)`



Telling that the function used ahead is by the library of GPIO or in other words by RPi.GPIO.



This is command to set up the role of a GPIO pin i.e. wether it will be used as input or output



We are mentioning which GPIO Pin would be set up



No we are telling that the pin 23 would be in high state or giving 3.3 Volt as output

GPIO.output(23, GPIO.HIGH)

Telling that the function used ahead is by the library of GPIO or in other words by RPi.GPIO.

Function of GPIO which tells what would be the output state of the GPIO pin

We are mentioning which GPIO Pin would be set up

No we are telling that the pin 23 would be in high state or giving 3.3 Volt as output

time.sleep(3)

We are mentioning that we are using a function that is from the library of time

sleep command would hold the program on this line of code. Remember if a pin is high then it will remain high during the sleep

We are mentioning how long this sleep will last in seconds.

GPIO.cleanup()



We are telling that the function after it is by the library of GPIO, or in other words by RPi.GPIO



This command will rest all the pins used in the program to its default values or low states

```
import RPI.GPIO as GPIO
import time

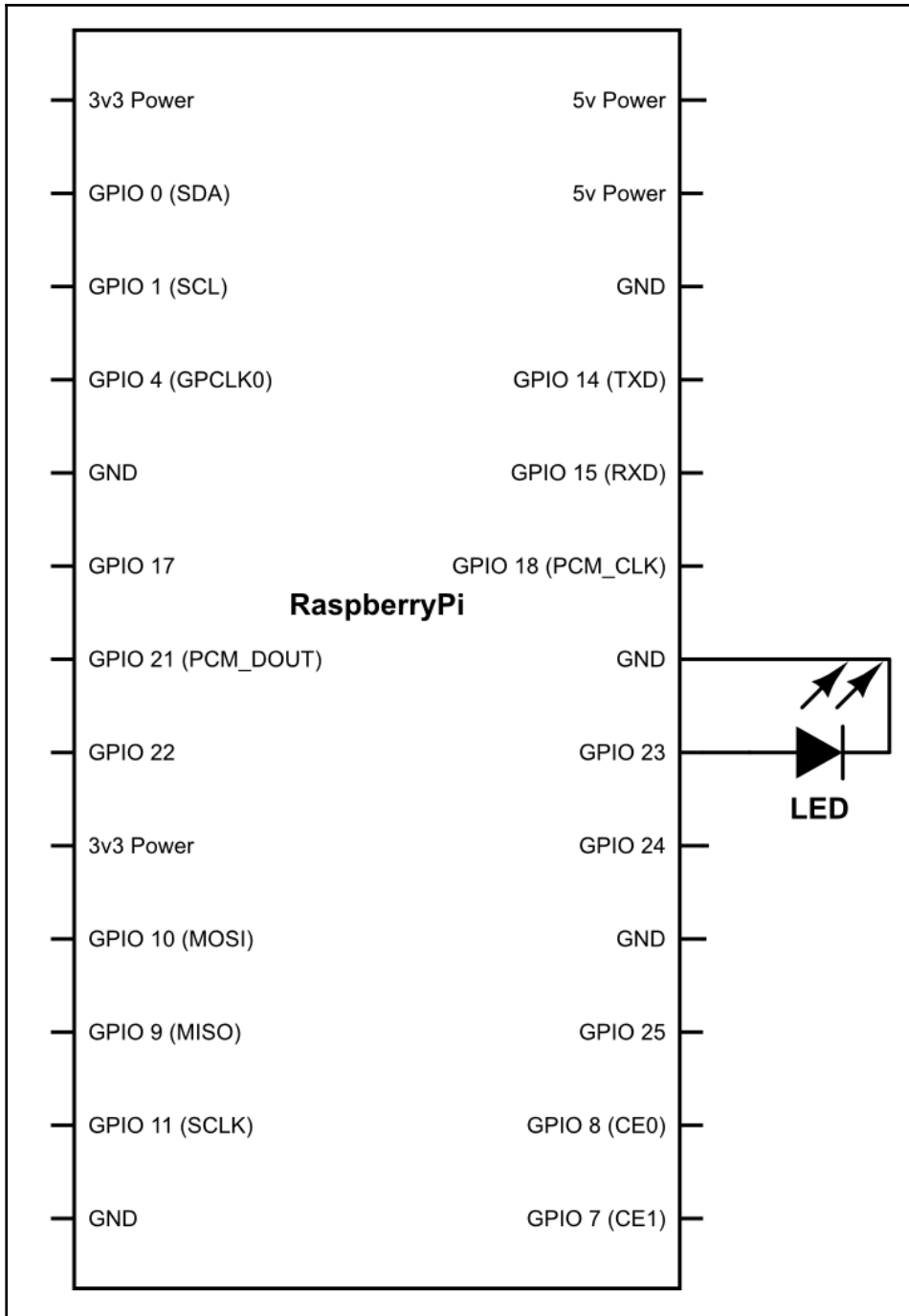
GPIO.setmode(GPIO.BCM)

GPIO.setup(23, GPIO.OUT)

GPIO.out(23, GPIO.High)

time.sleep(3)

GPIO.cleanup()
```



```
for i in range(7,12):
```



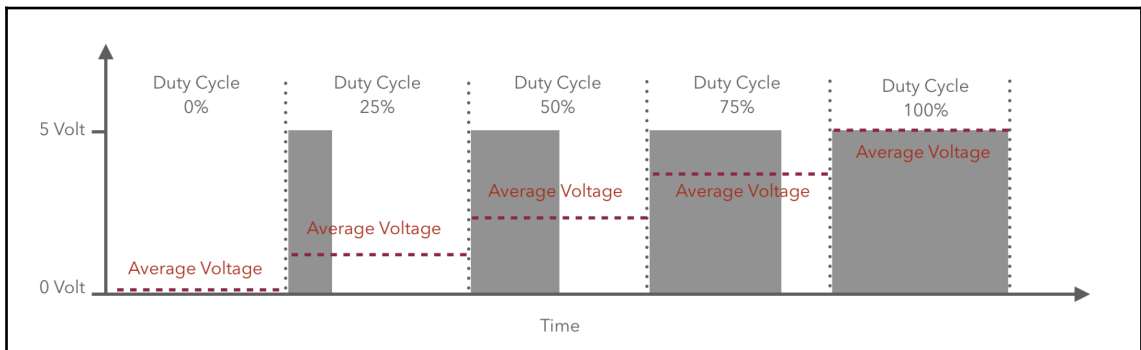
It will start running the loop for $i = 7$ and increment it by 1 every single time it runs. The statement would be false when the $i < 12$ so it will stop the loop and move ahead in code.



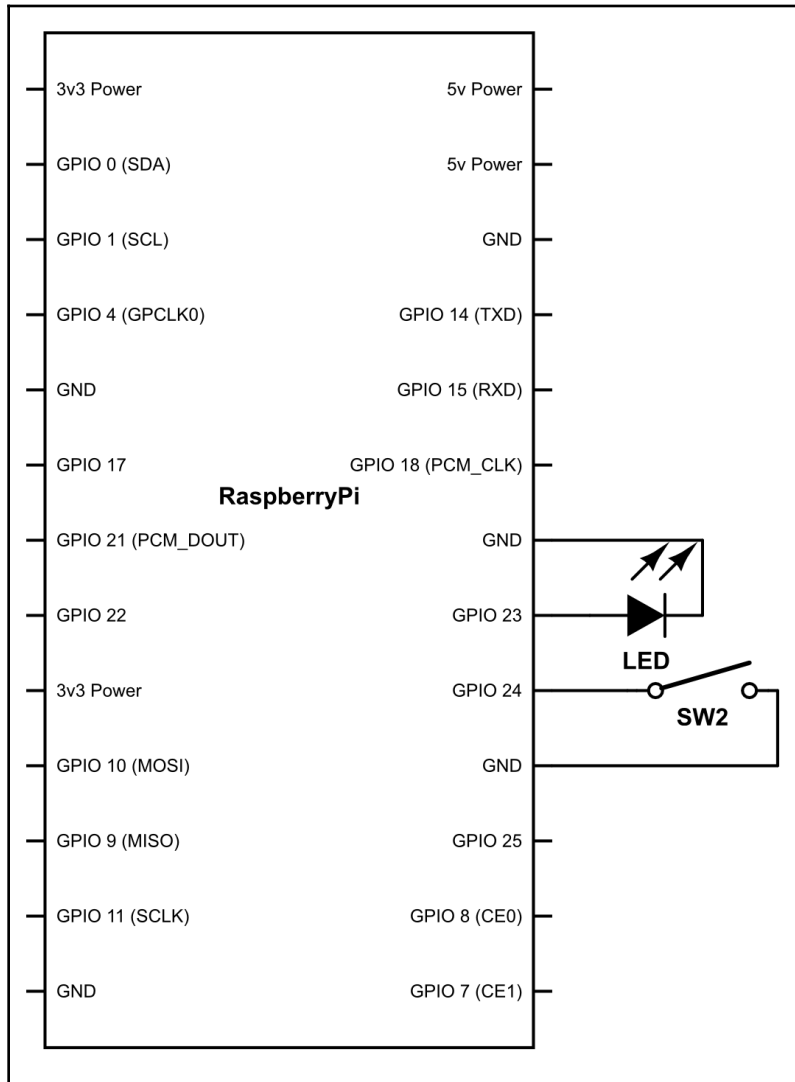
The starting of the range is from 7



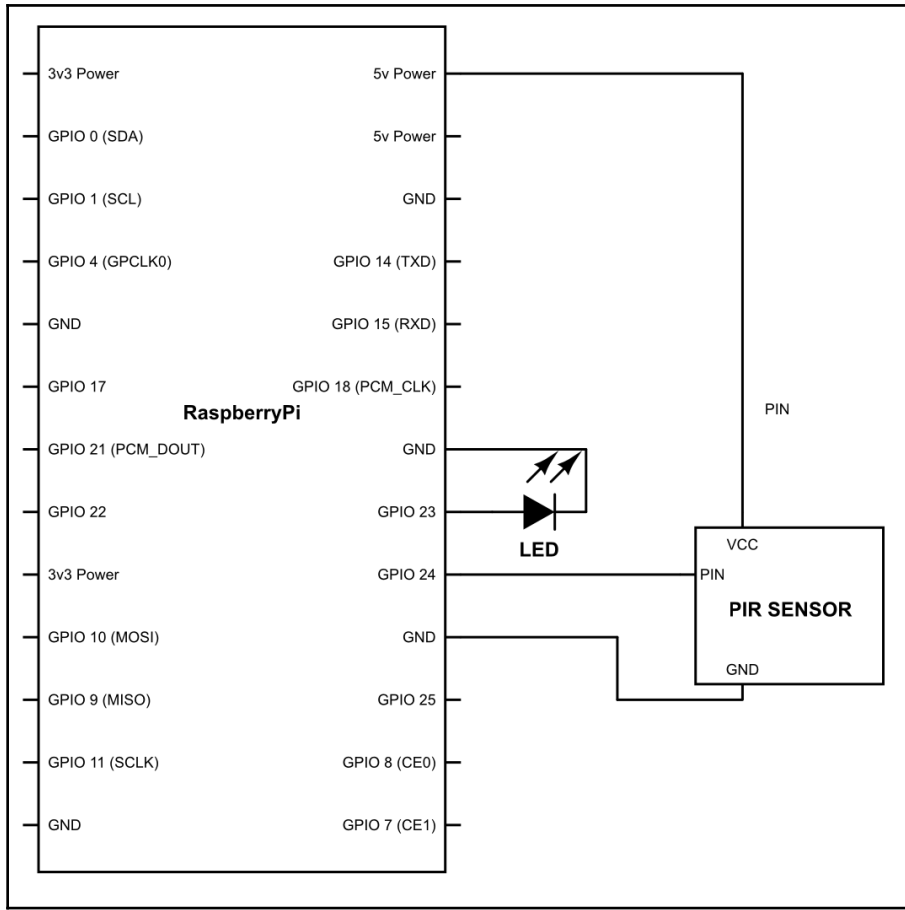
The end of the range is at 12

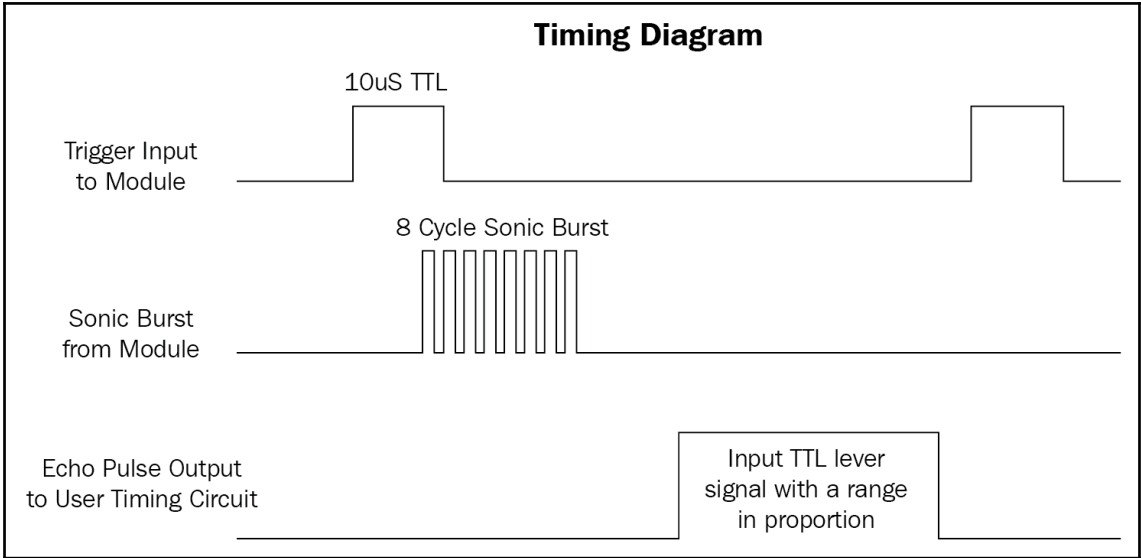


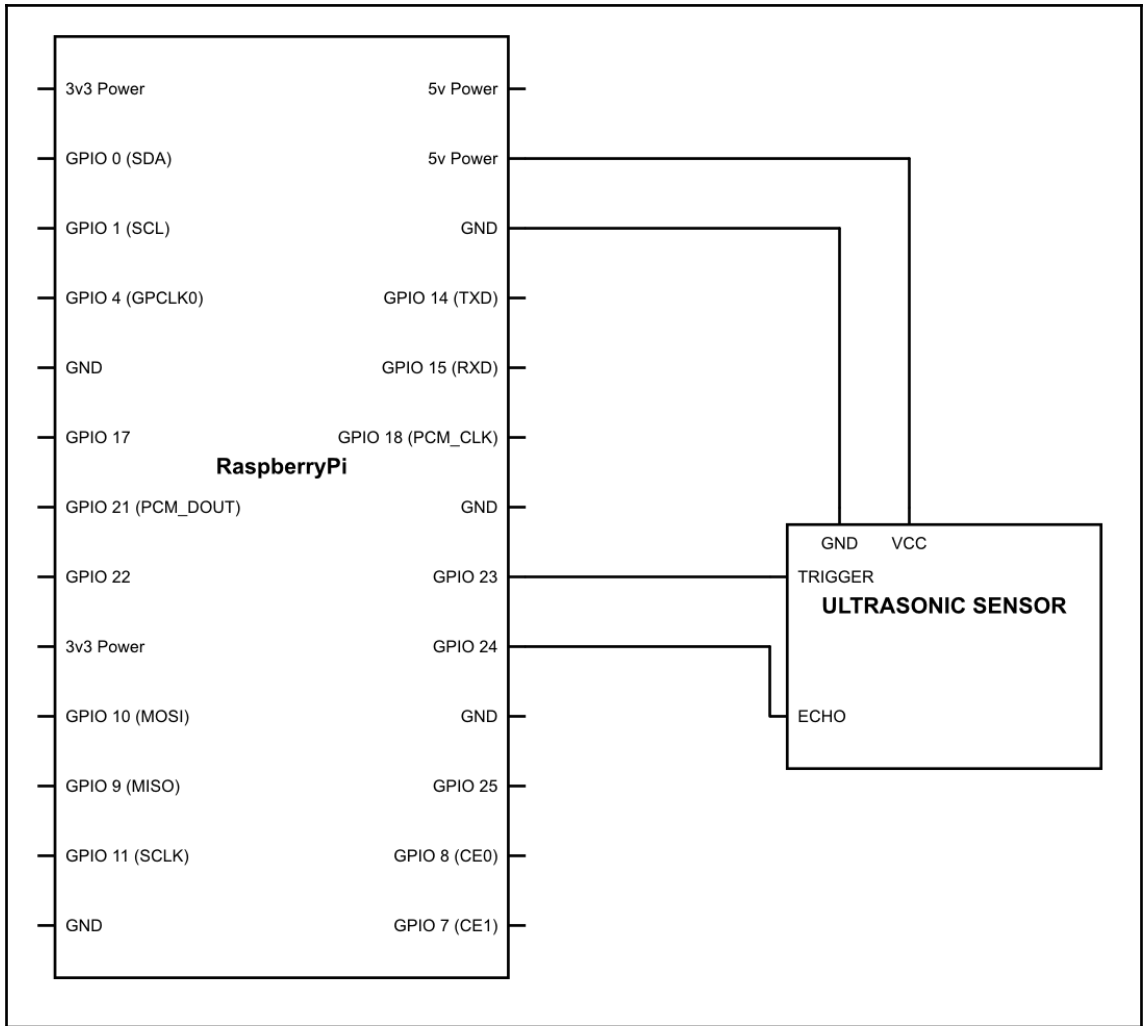
Chapter 2: Using GPIOs as Input

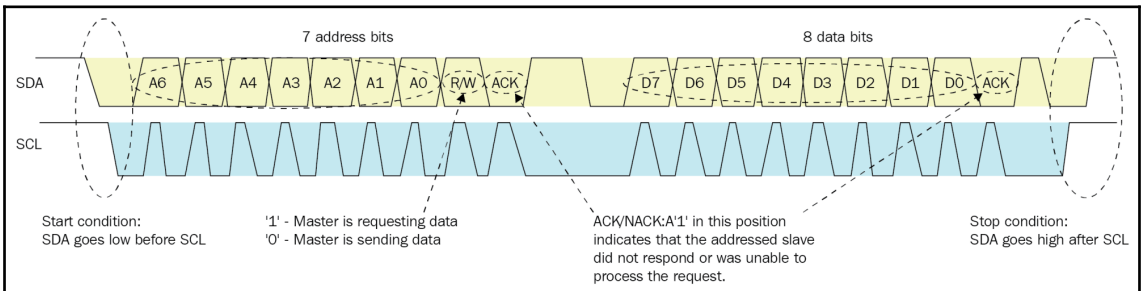
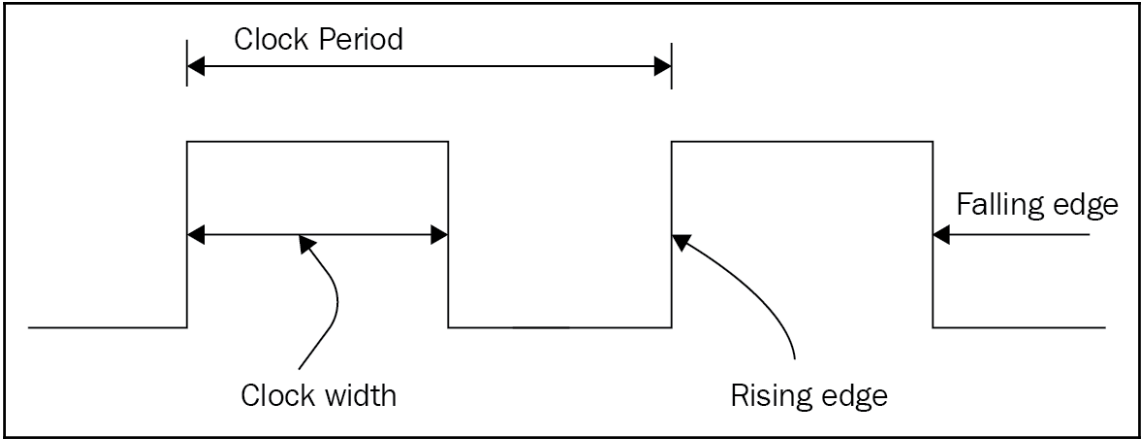
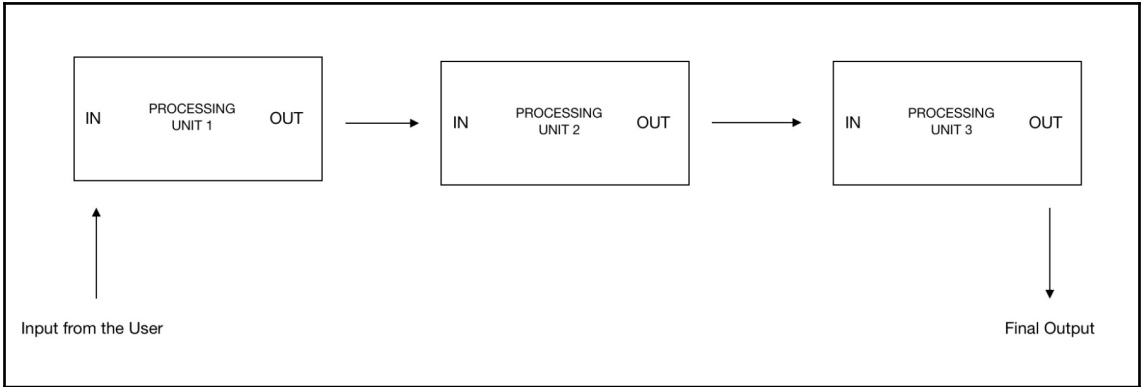












Raspberry Pi 3 Model B Rev 1.2

Raspberry Pi Software Configuration Tool (raspi-config)

- | | |
|------------------------------|--|
| 1 Change User Password | Change password for the current u |
| 2 Hostname | Set the visible name for this Pi |
| 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>

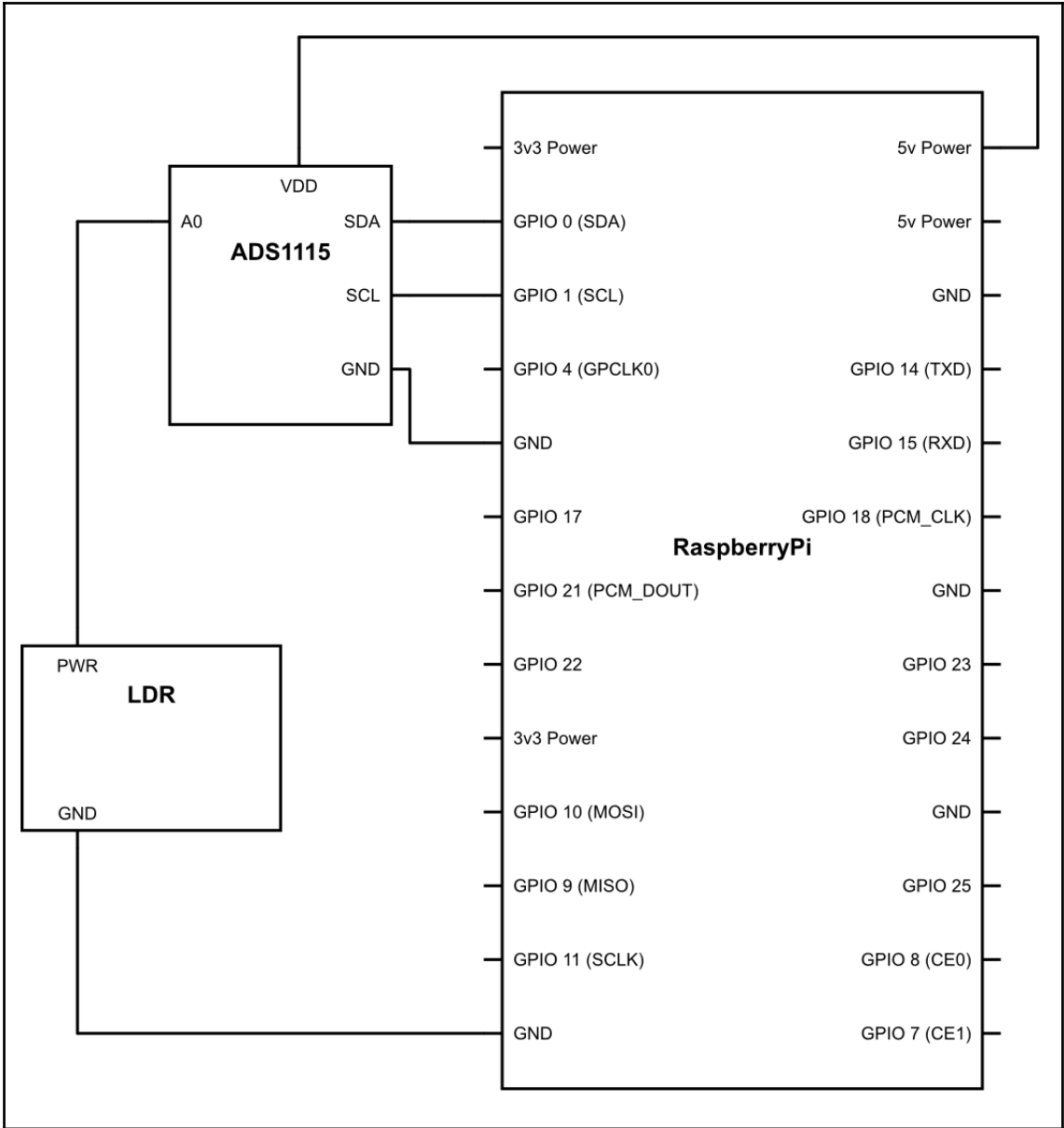
Raspberry Pi Software Configuration Tool (raspi-config)

- | | |
|----------------|---|
| P1 Camera | Enable/Disable connection to the |
| P2 SSH | Enable/Disable remote command lin |
| P3 VNC | Enable/Disable graphical remote a |
| P4 SPI | Enable/Disable automatic loading |
| P5 I2C | Enable/Disable automatic loading |
| P6 Serial | Enable/Disable shell and kernel m |
| P7 1-Wire | Enable/Disable one-wire interface |
| P8 Remote GPIO | Enable/Disable remote access to G |

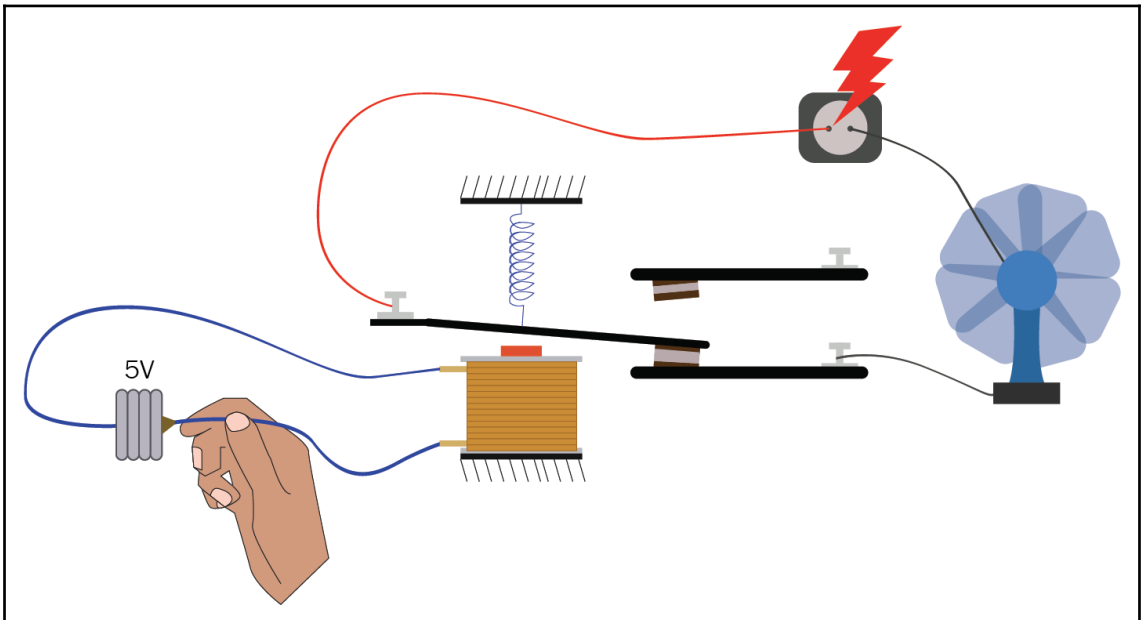
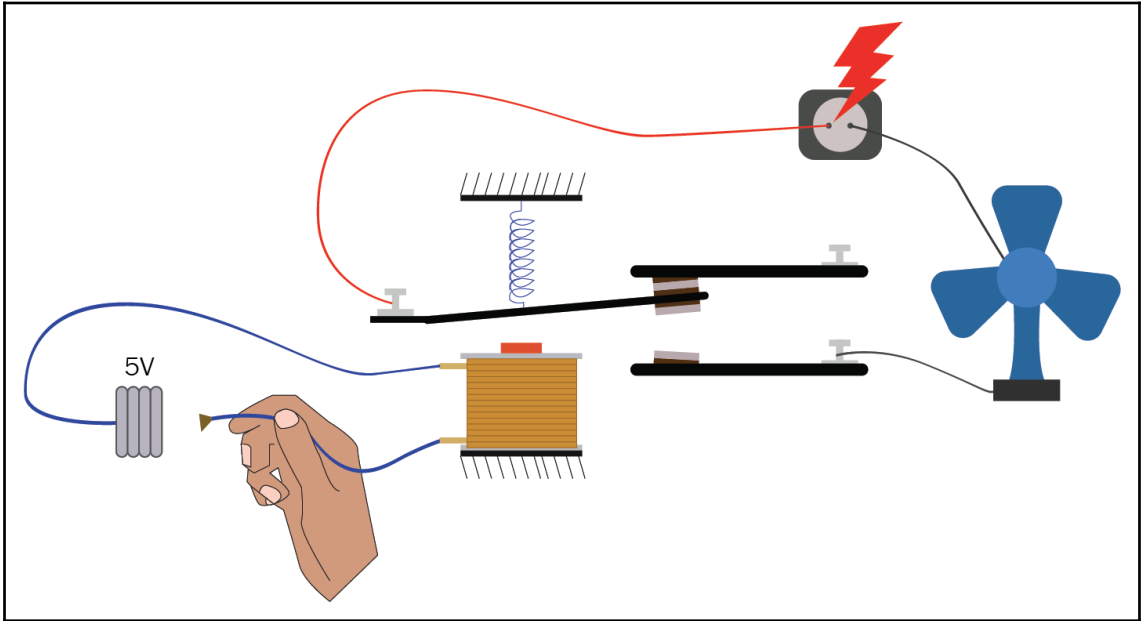
<Select>

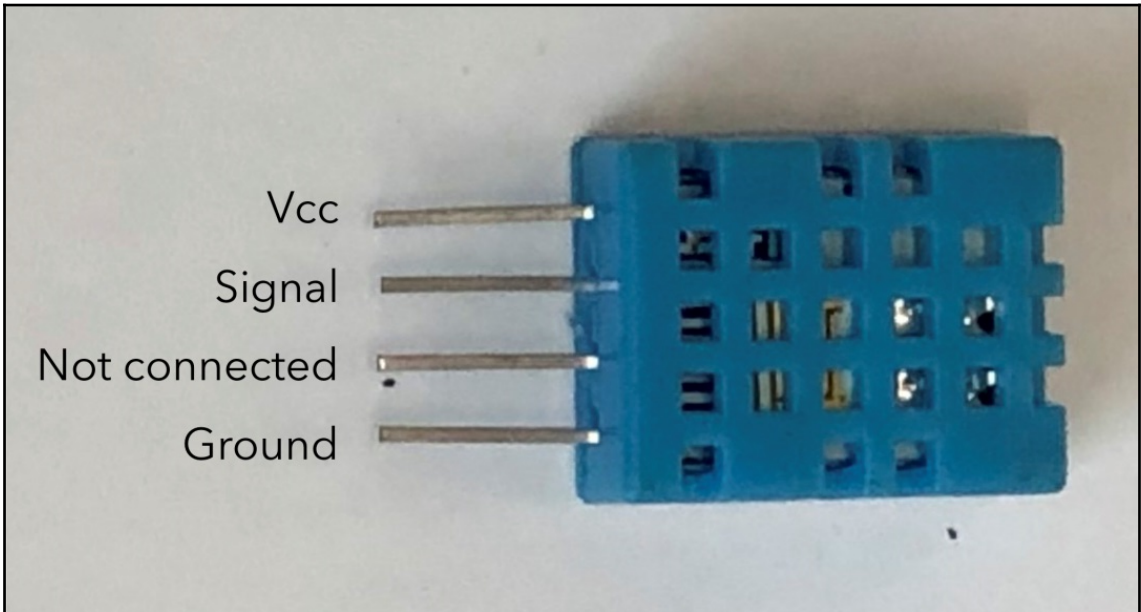
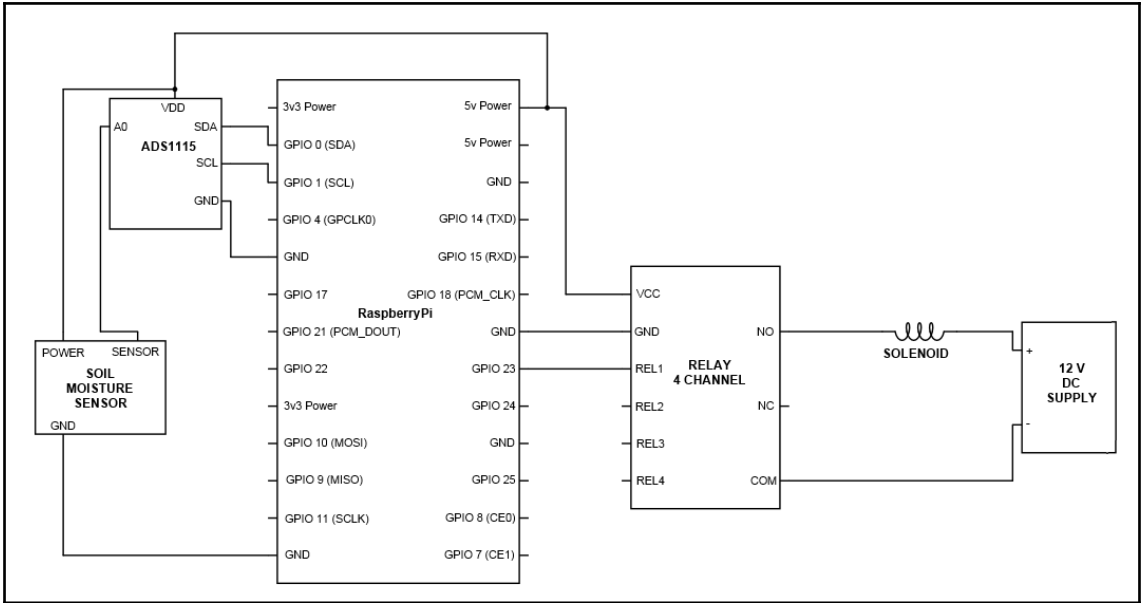
<Back>

Would you like the ARM I2C interface to be enabled?



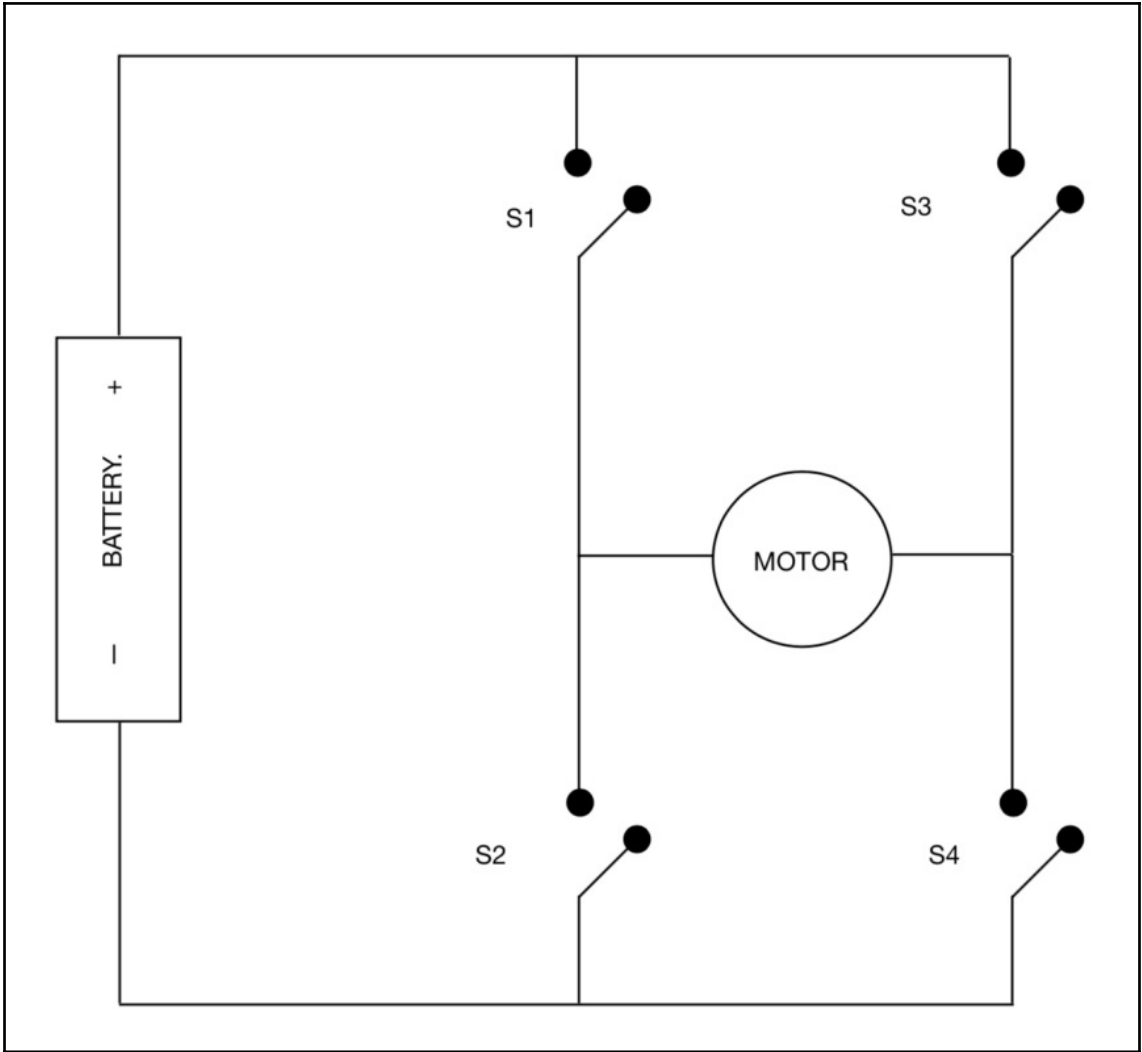
Chapter 3: Making a Gardener Robot

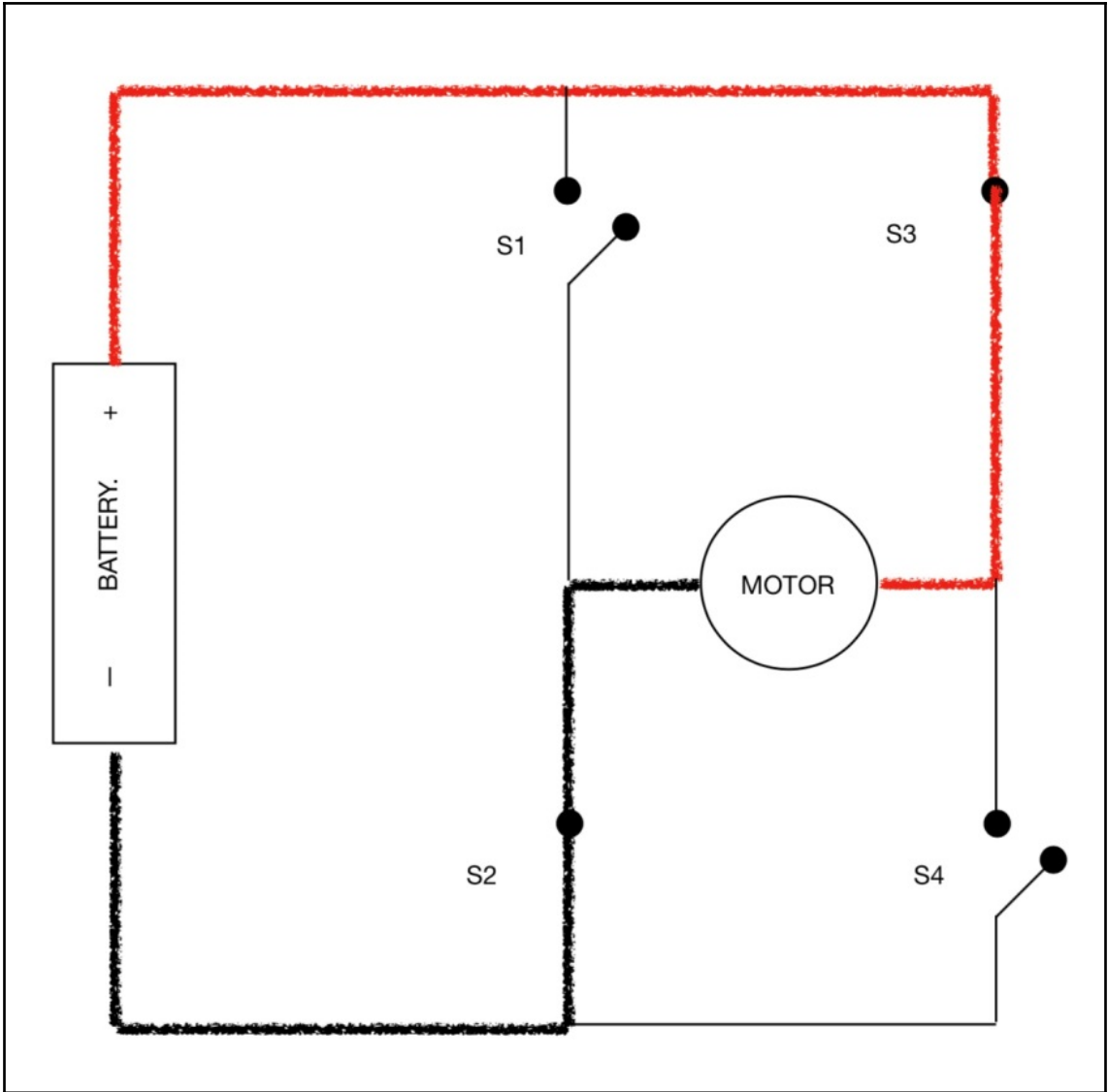


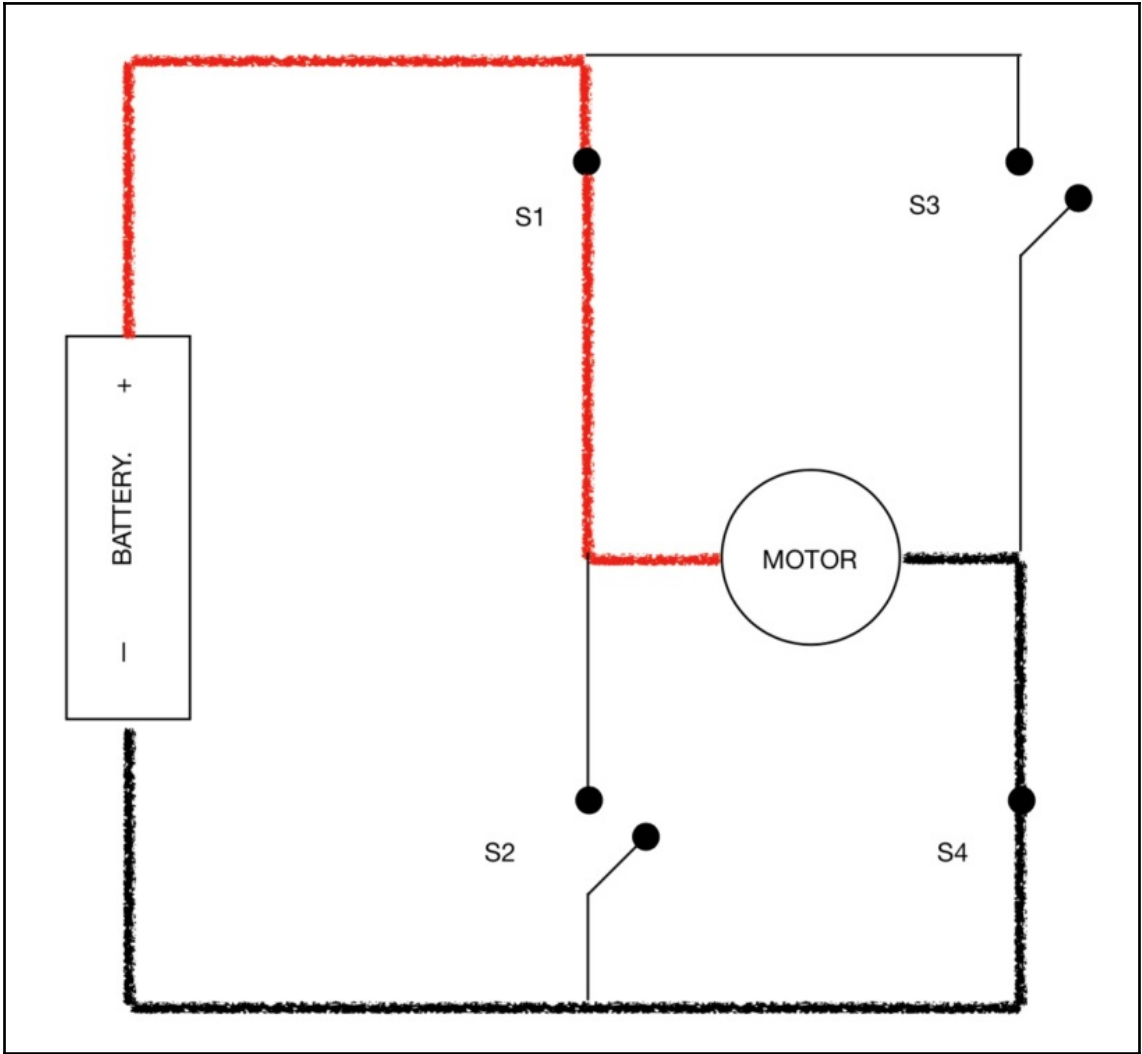


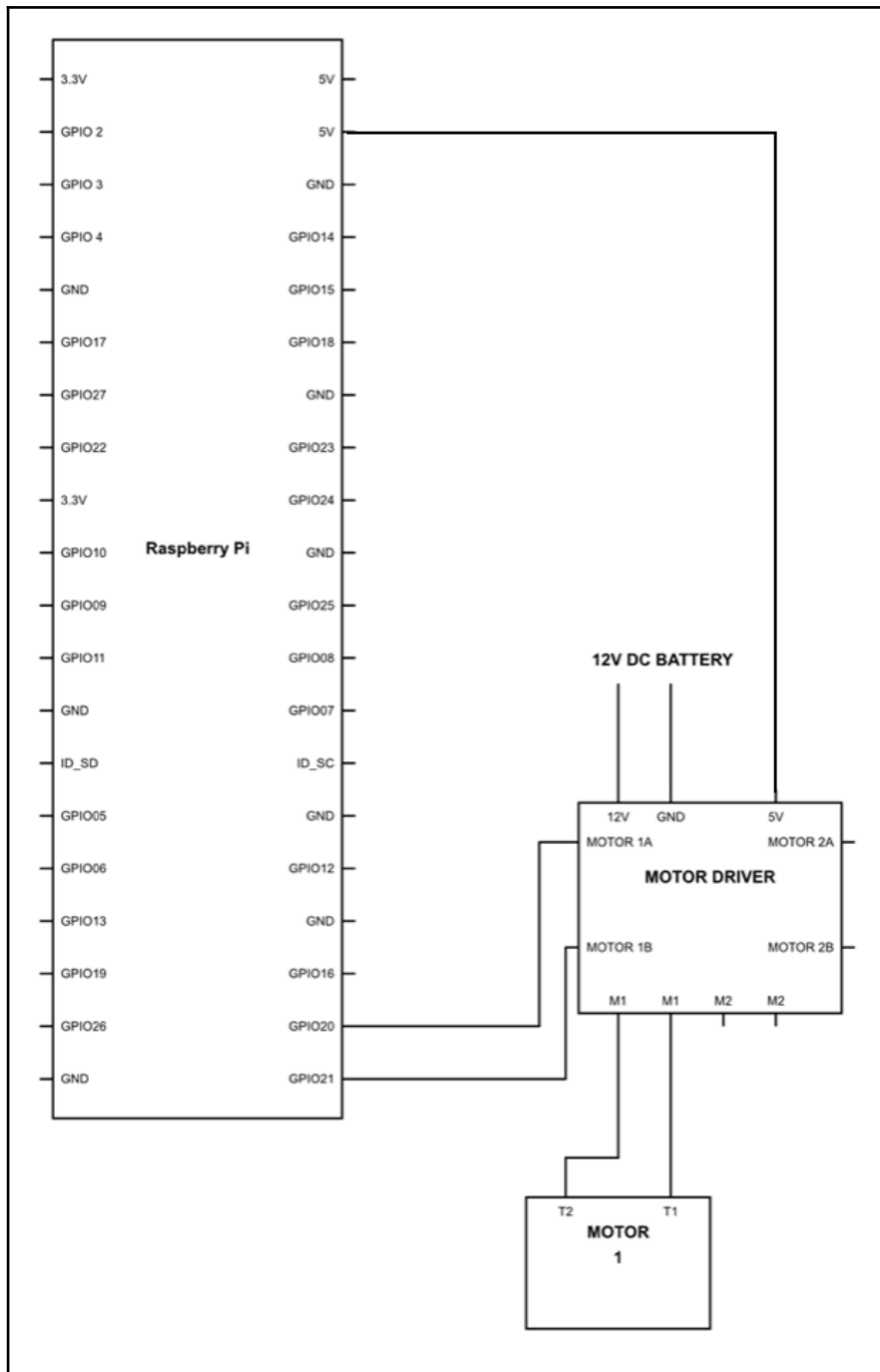
Chapter 4: Basics of Motors



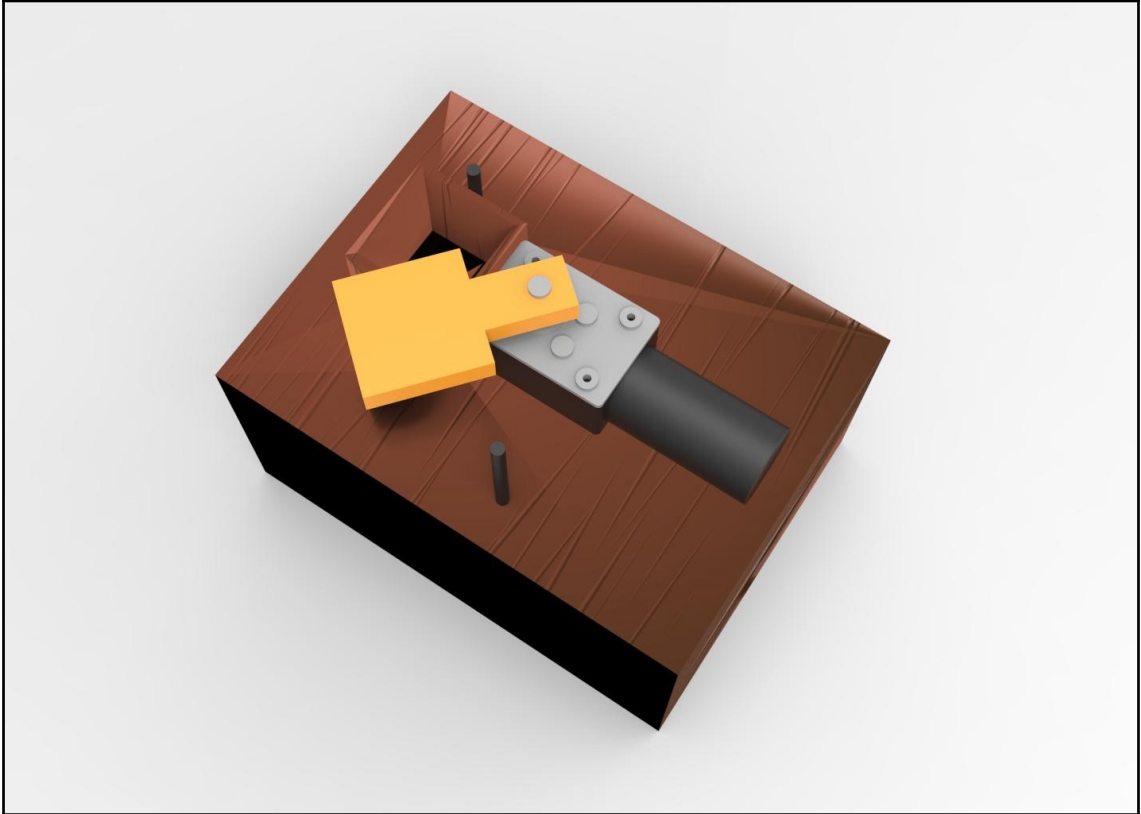


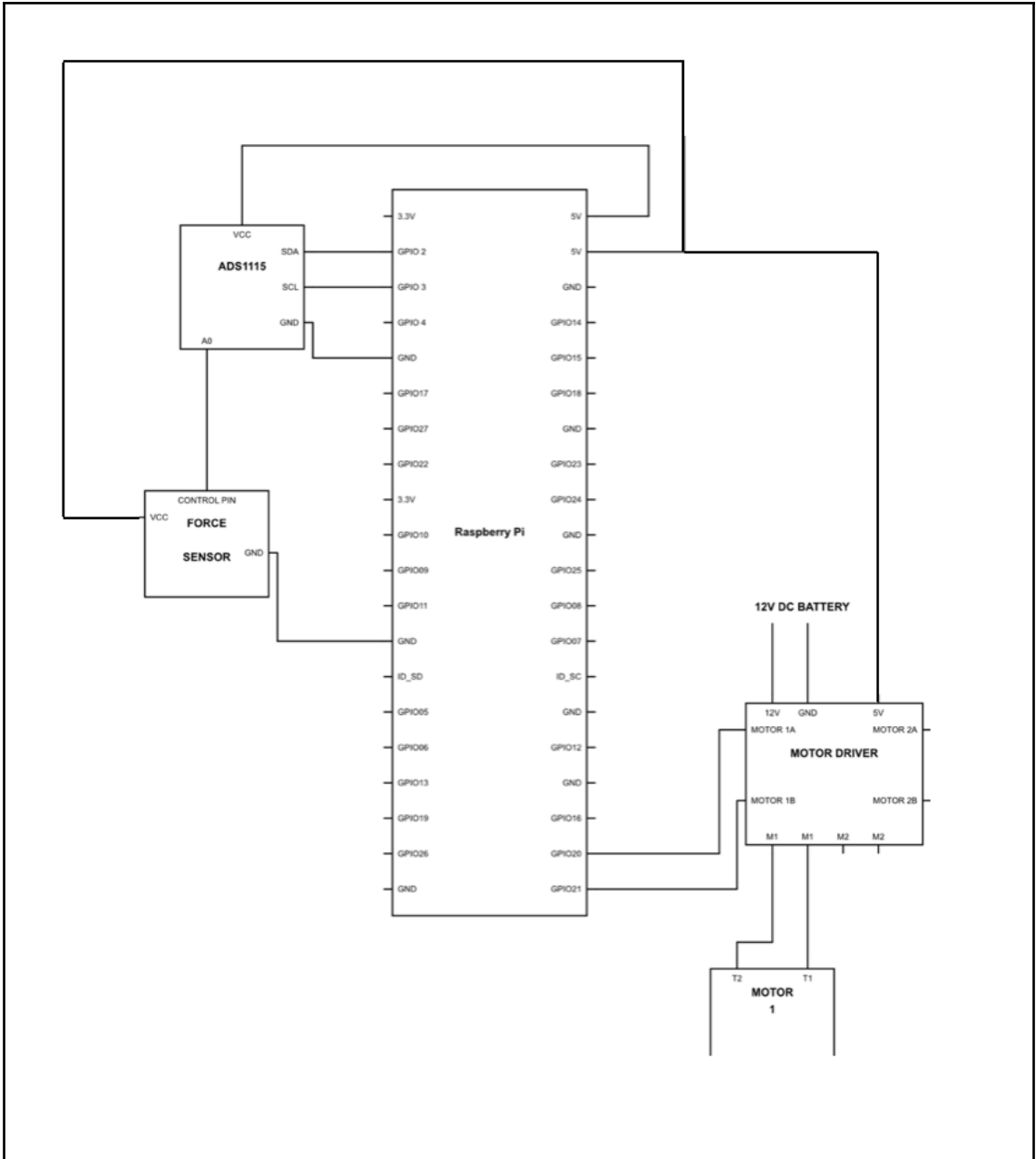


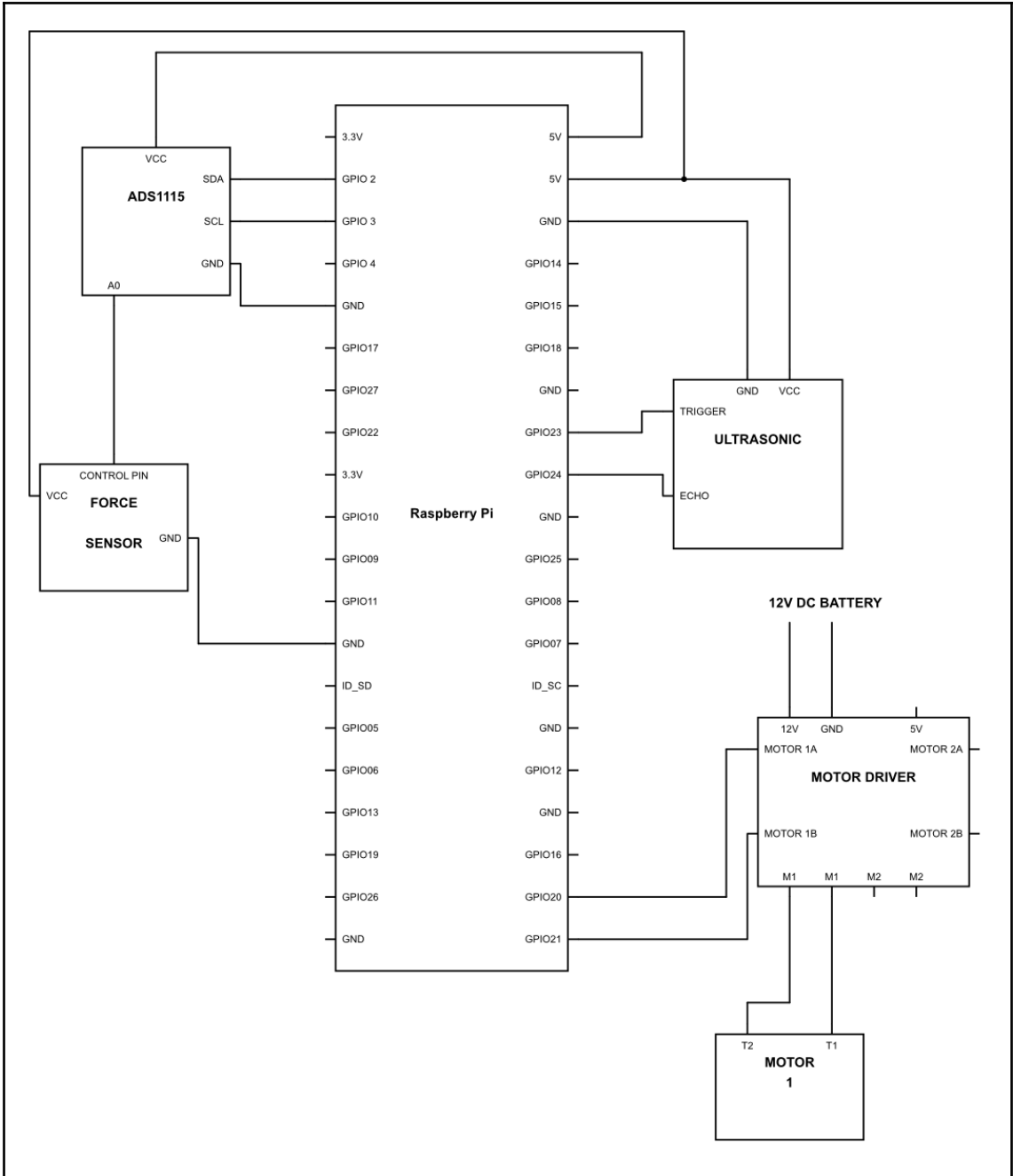




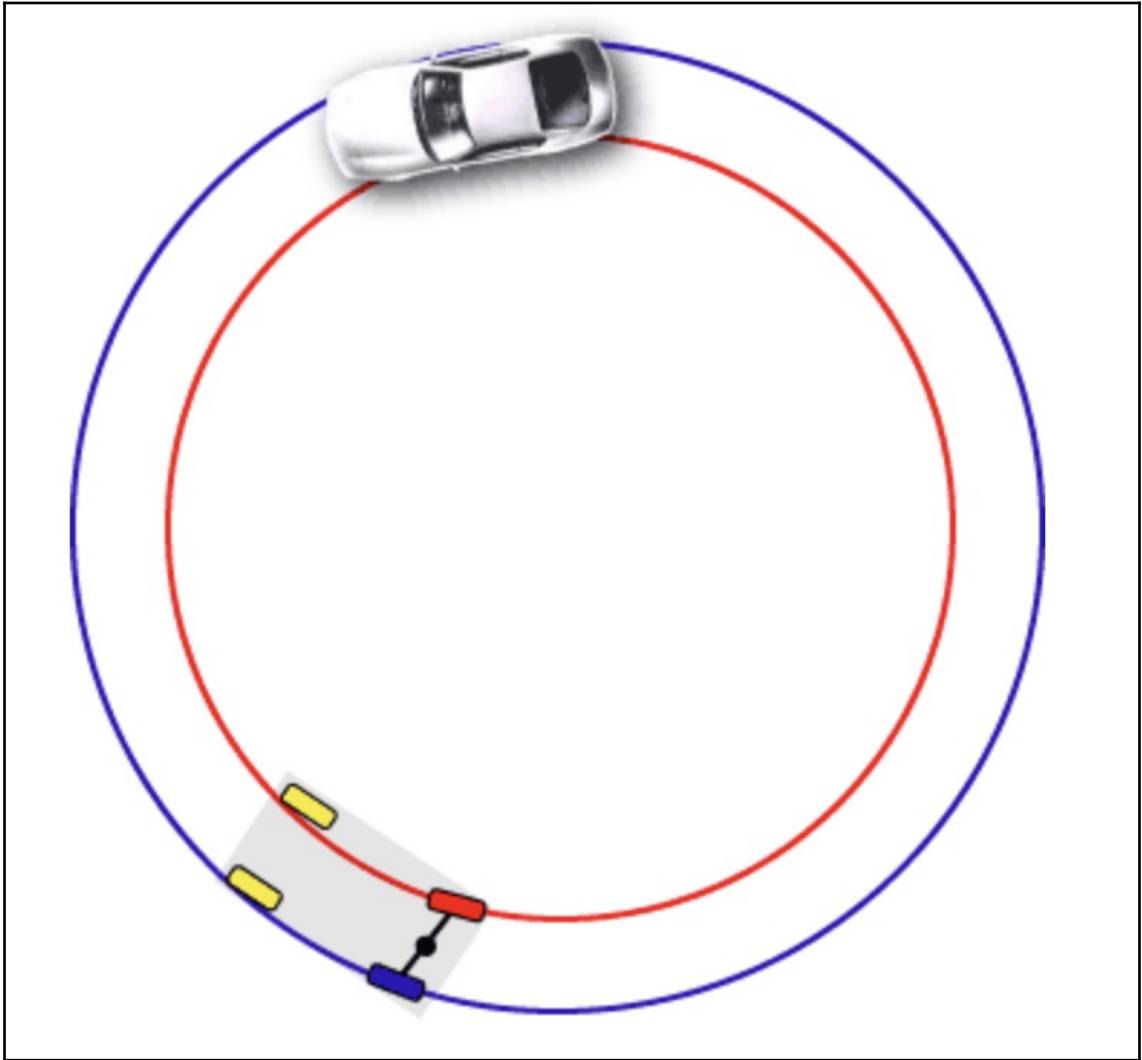
Chapter 5: Making a Pet Feeding Robot

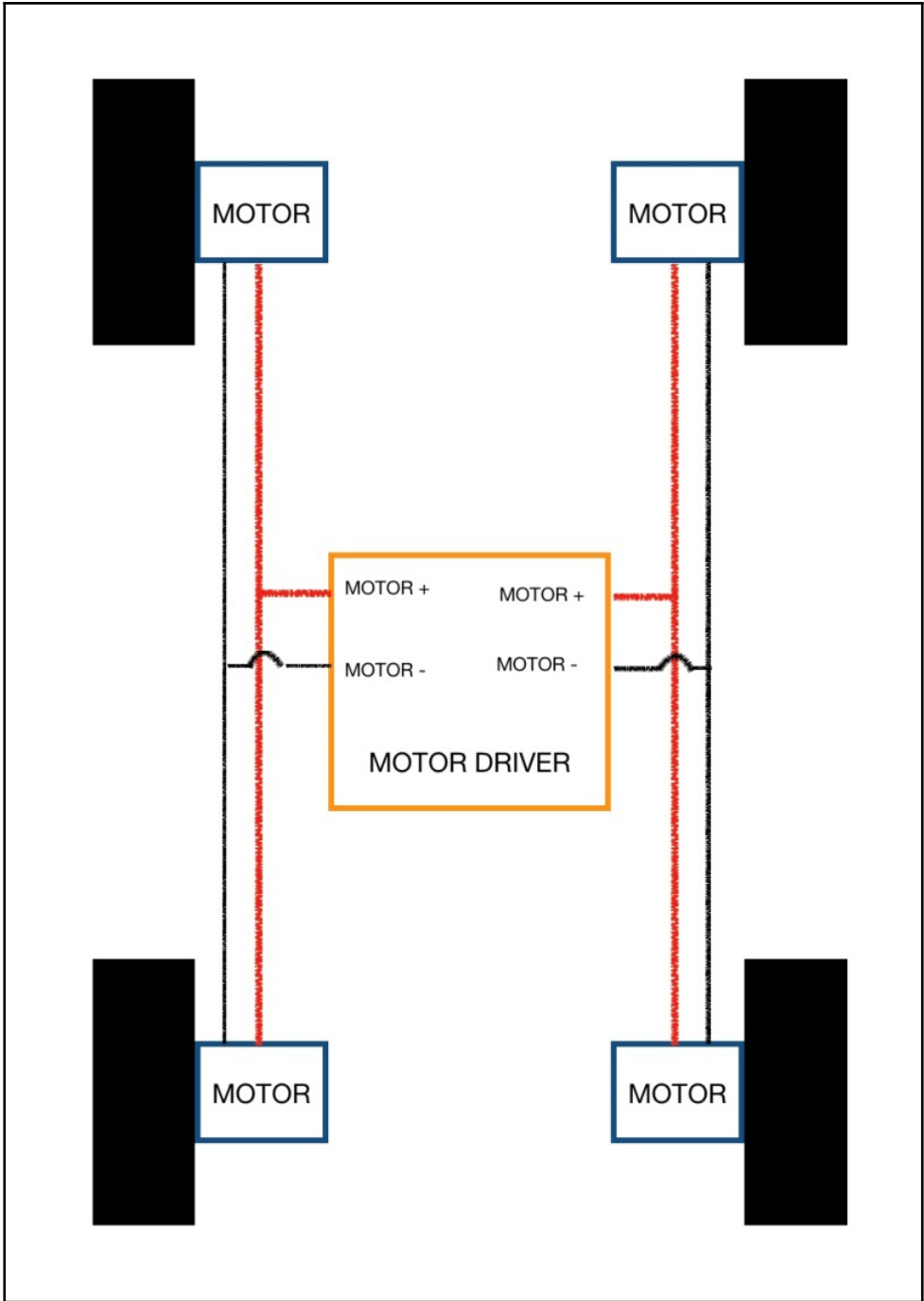


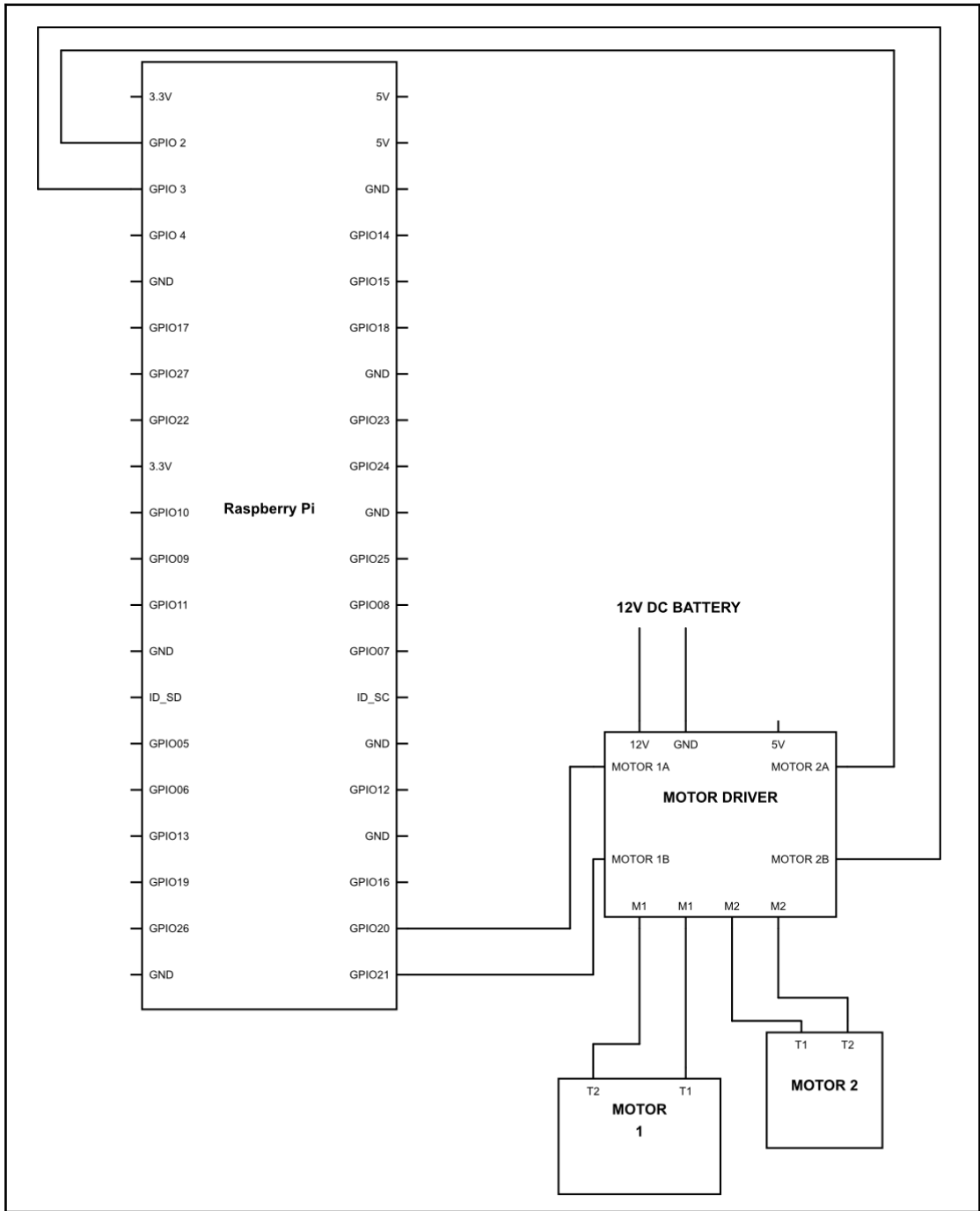




Chapter 6: Bluetooth-Controlled Robotic Car

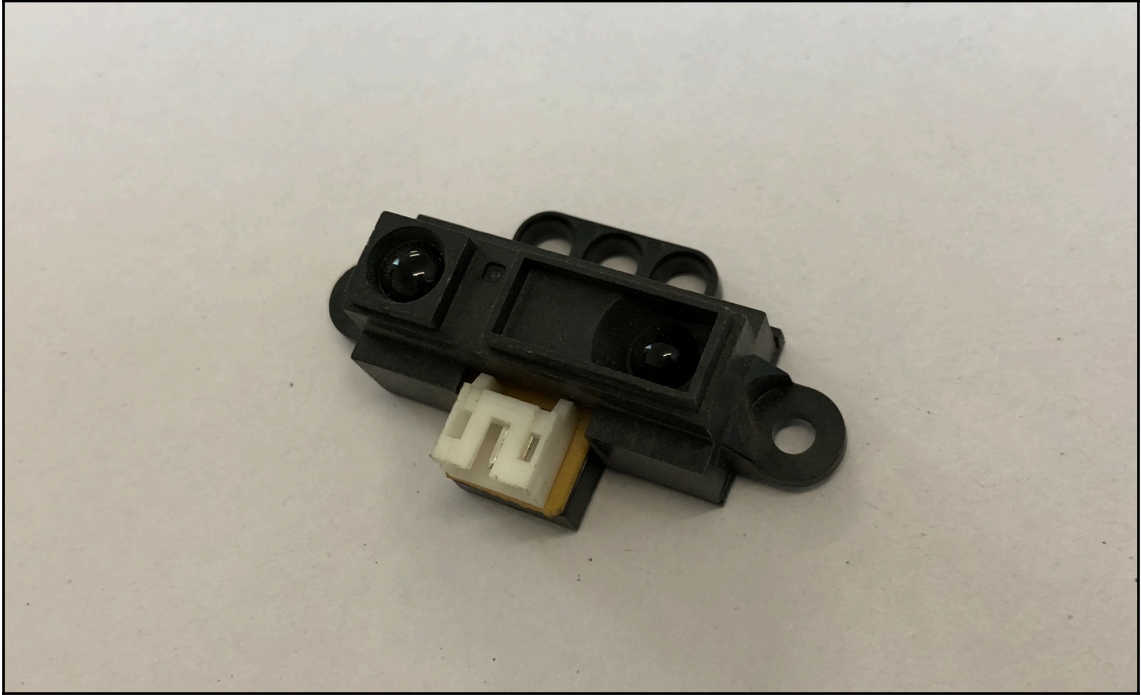


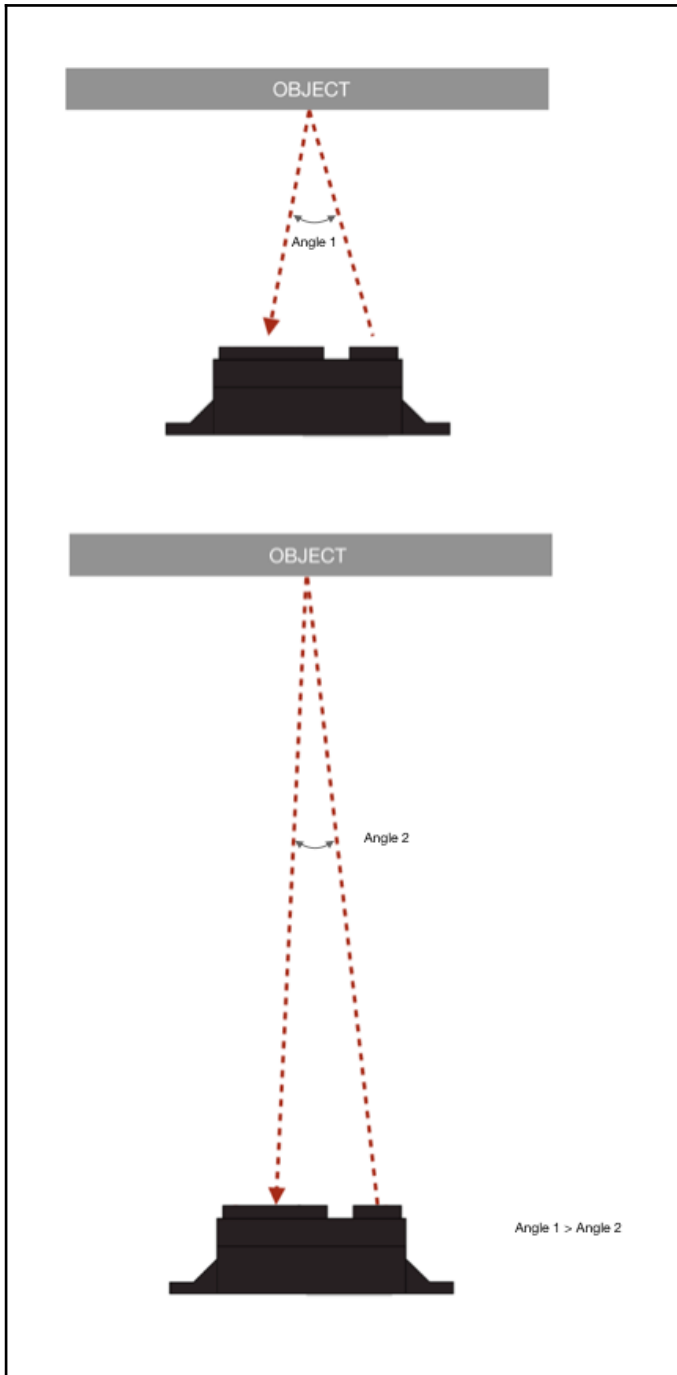


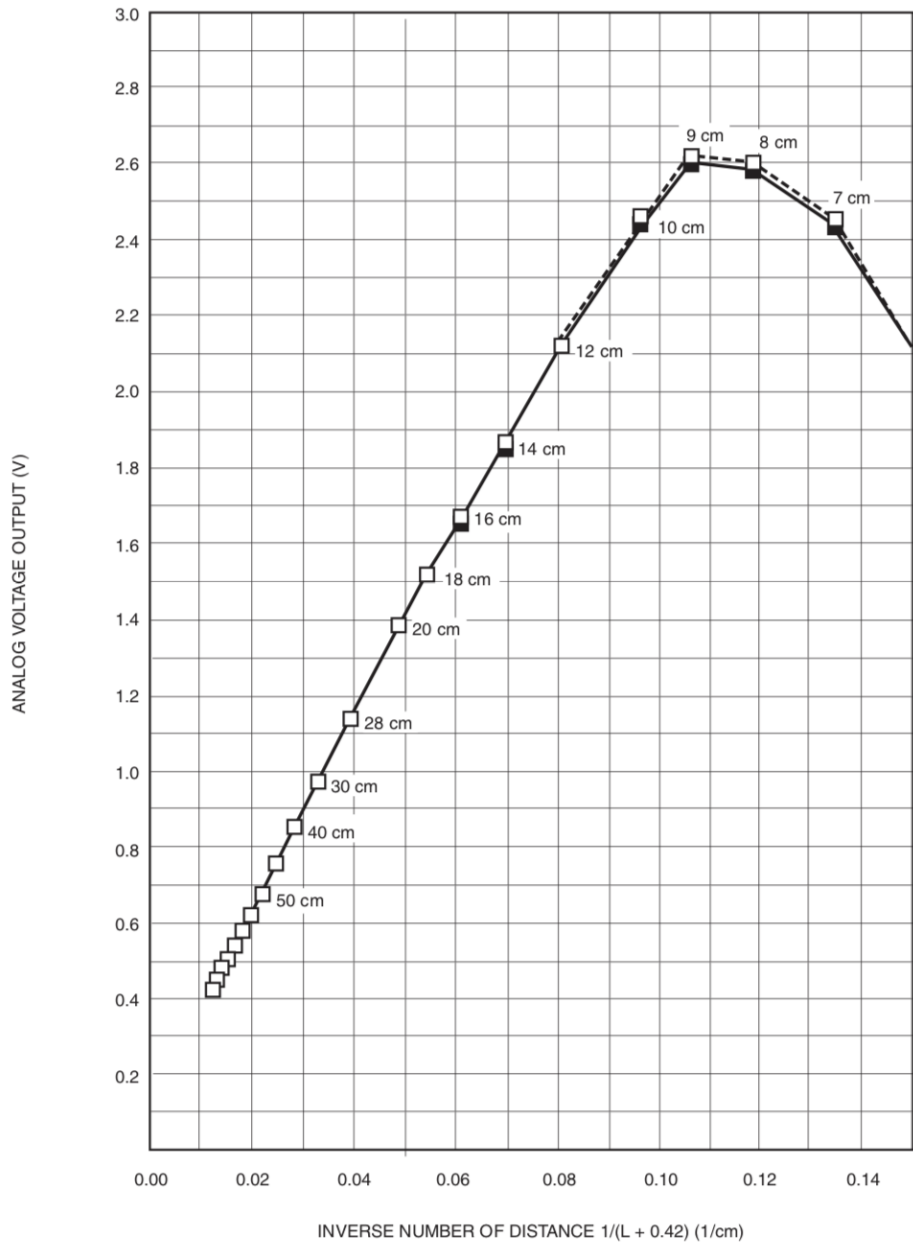


```
pi@raspberrypi: ~  
pi@raspberrypi:~ $ bluetoothctl  
[NEW] Controller B8:27:EB:2B:9B:73 raspberrypi [default]  
[NEW] Device 94:65:2D:94:9B:D3 AjayPlus5  
[bluetooth]# power on  
Changing power on succeeded  
[bluetooth]# agent on  
Agent registered  
[bluetooth]# discoverable on  
Changing discoverable on succeeded  
[CHG] Controller B8:27:EB:2B:9B:73 Discoverable: yes  
[bluetooth]# pairable on  
Changing pairable on succeeded  
[bluetooth]# scan on  
Discovery started  
[CHG] Controller B8:27:EB:2B:9B:73 Discovering: yes  
[NEW] Device 55:34:68:3F:77:FD 55-34-68-3F-77-FD  
[NEW] Device DC:A9:04:73:A6:B7 DC-A9-04-73-A6-B7  
[bluetooth]# pair 94:65:2D:94:9B:D3  
Attempting to pair with 94:65:2D:94:9B:D3  
Failed to pair: org.bluez.Error.AlreadyExists  
[bluetooth]#
```

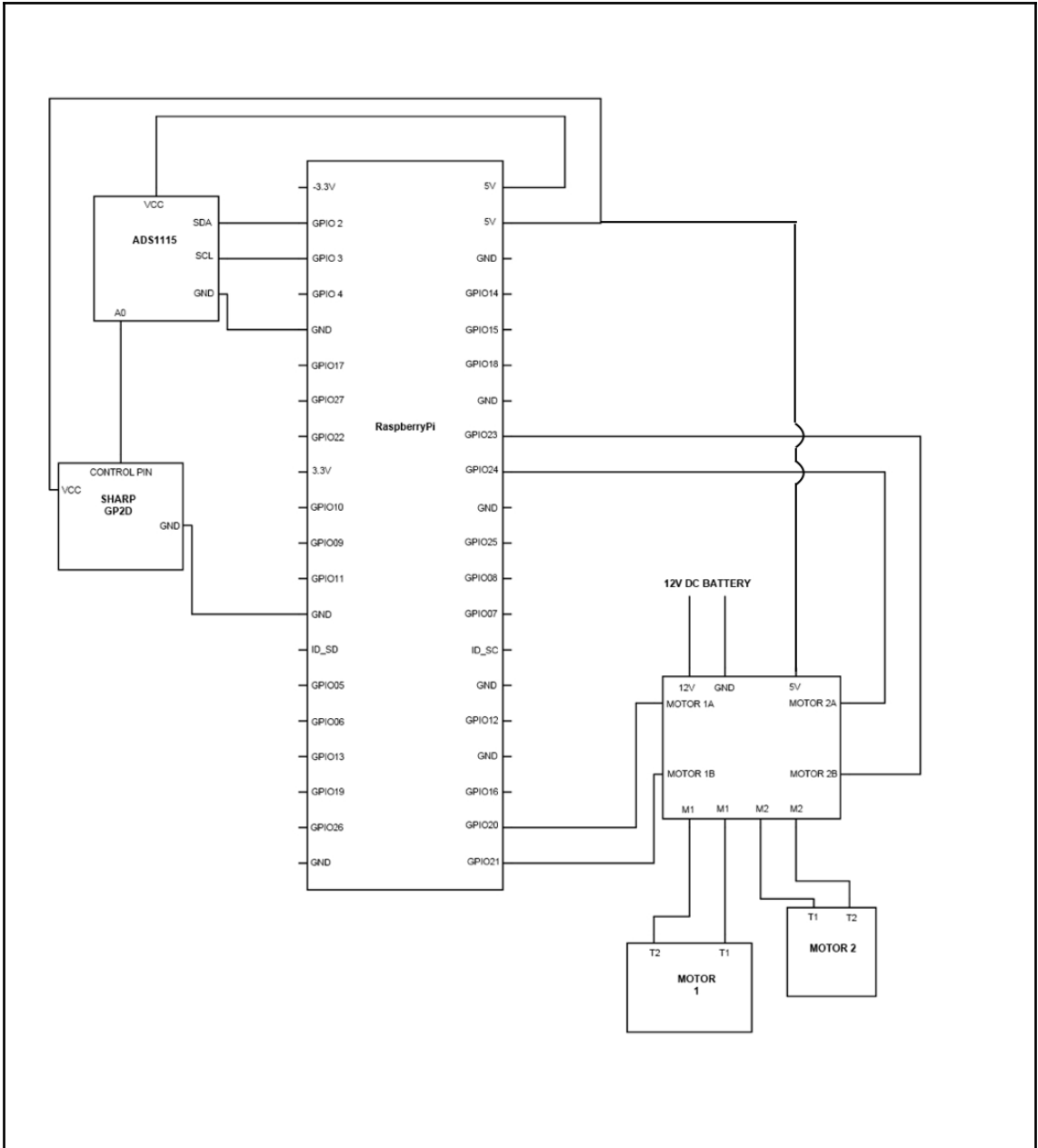
Chapter 7: Sensor Interface for Obstacle Avoidance



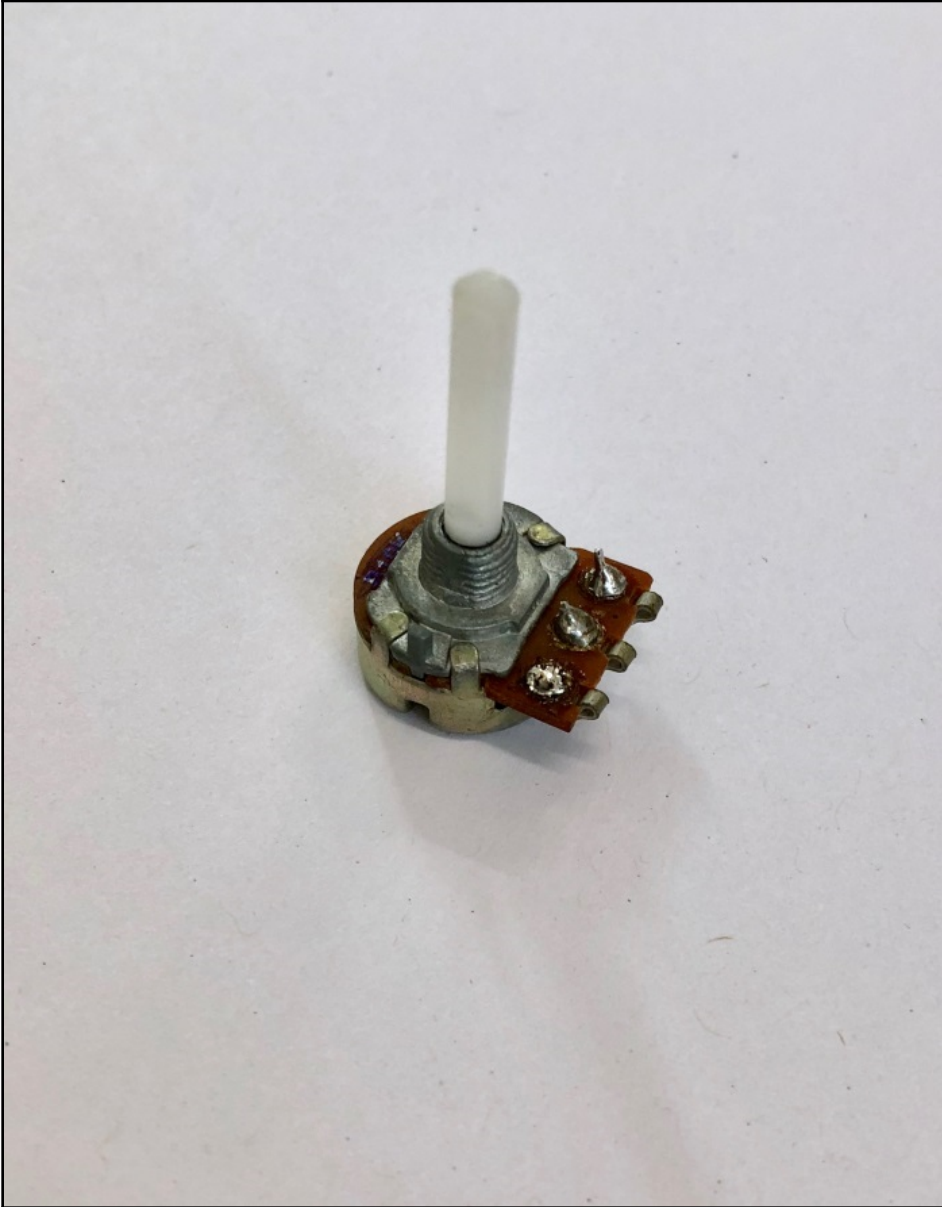


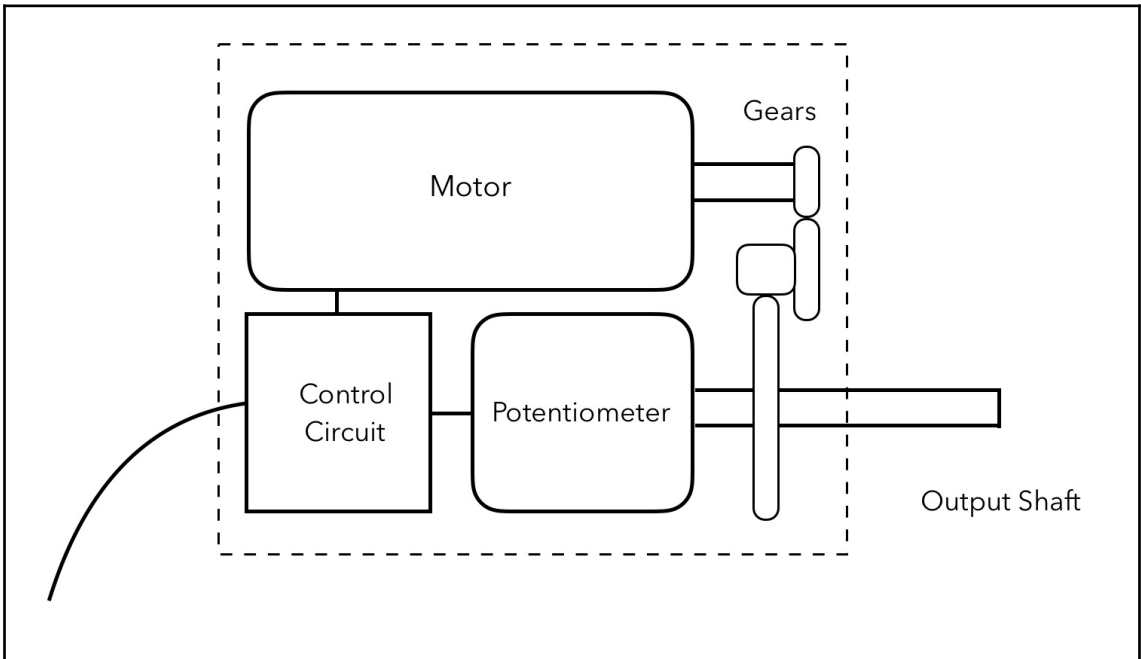
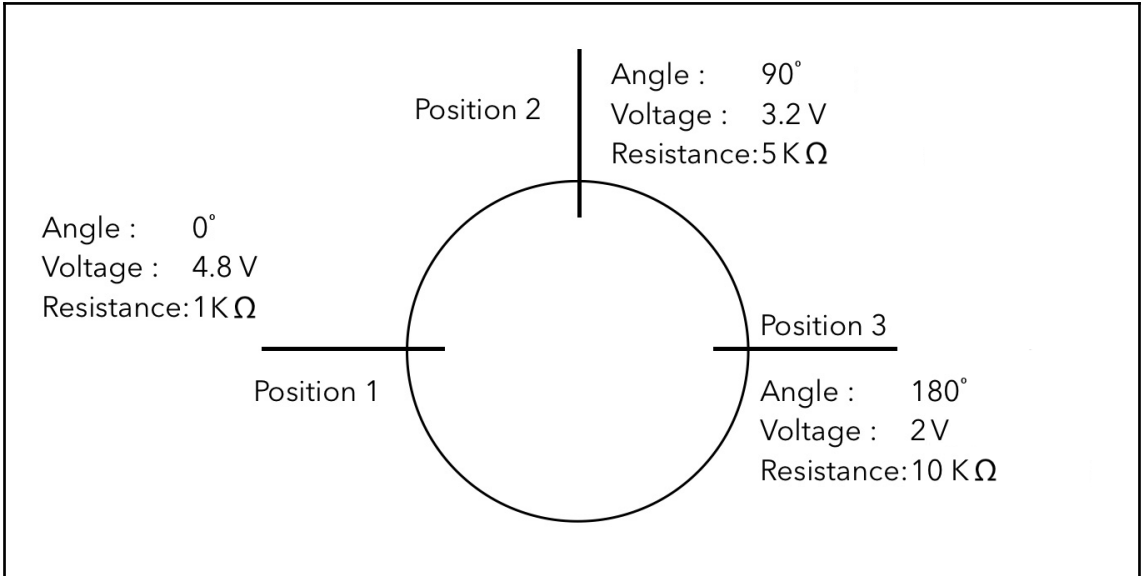


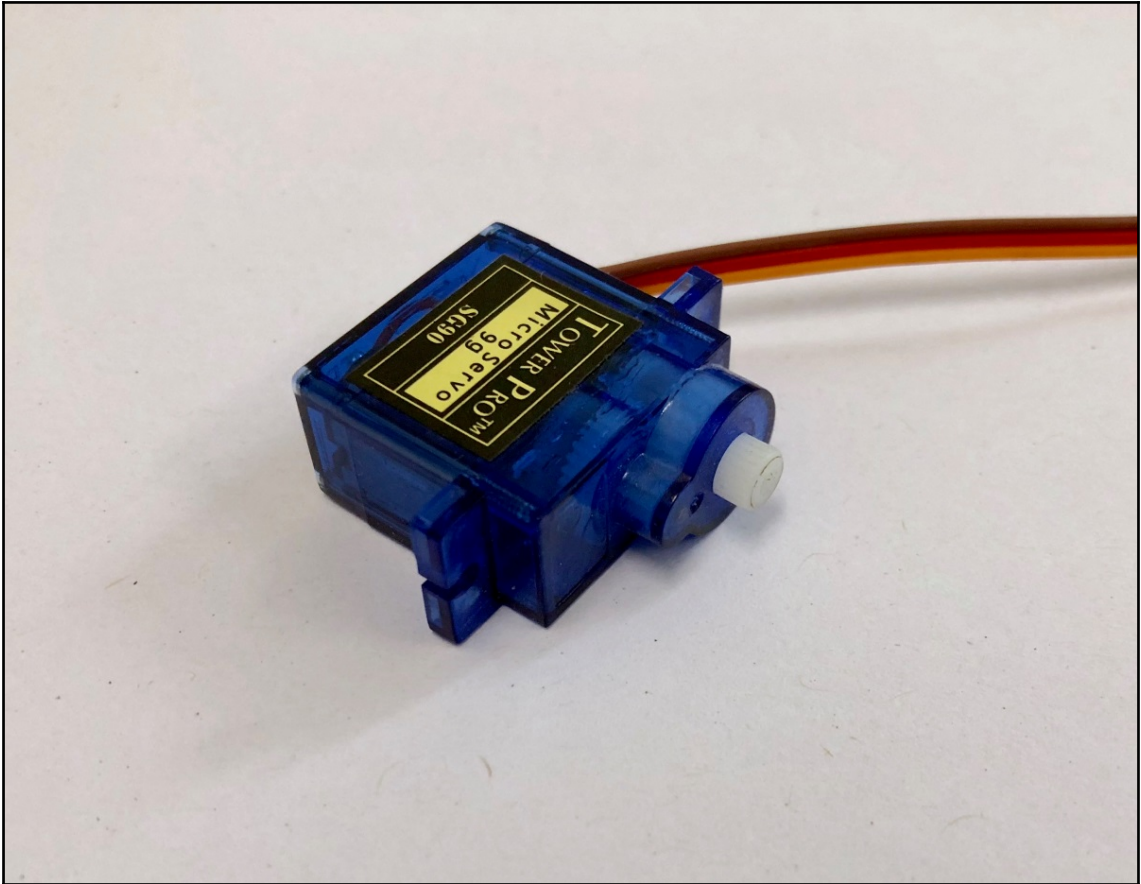
NOTES:
 ■ White paper (Reflectance ratio 90%)
 □ Gray paper (Reflectance ratio 18%)

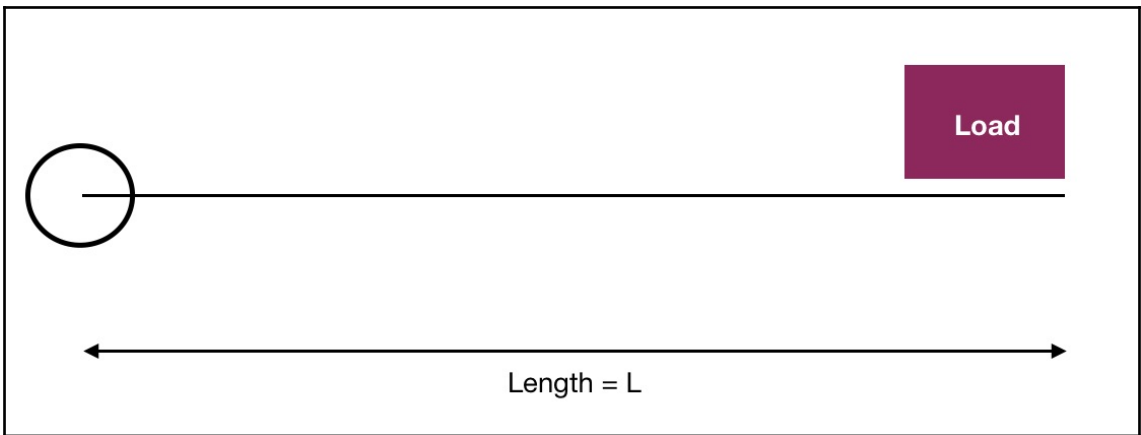
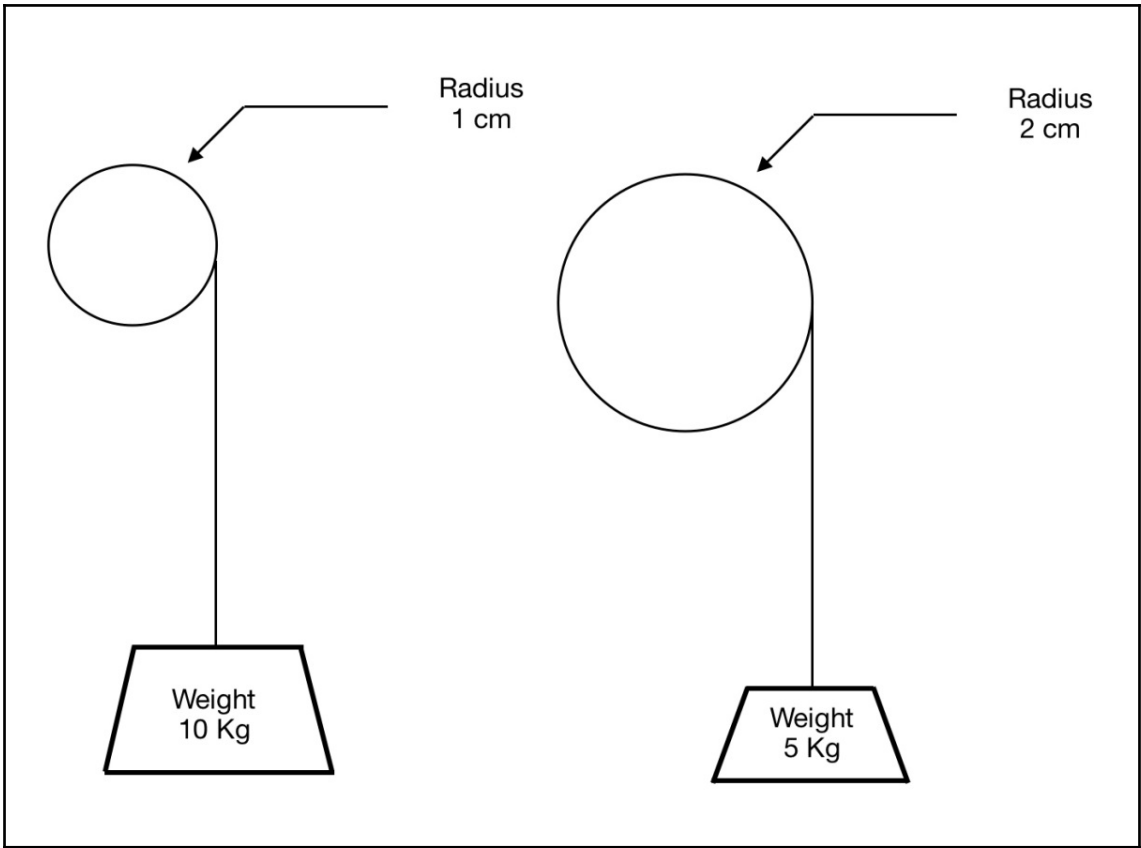


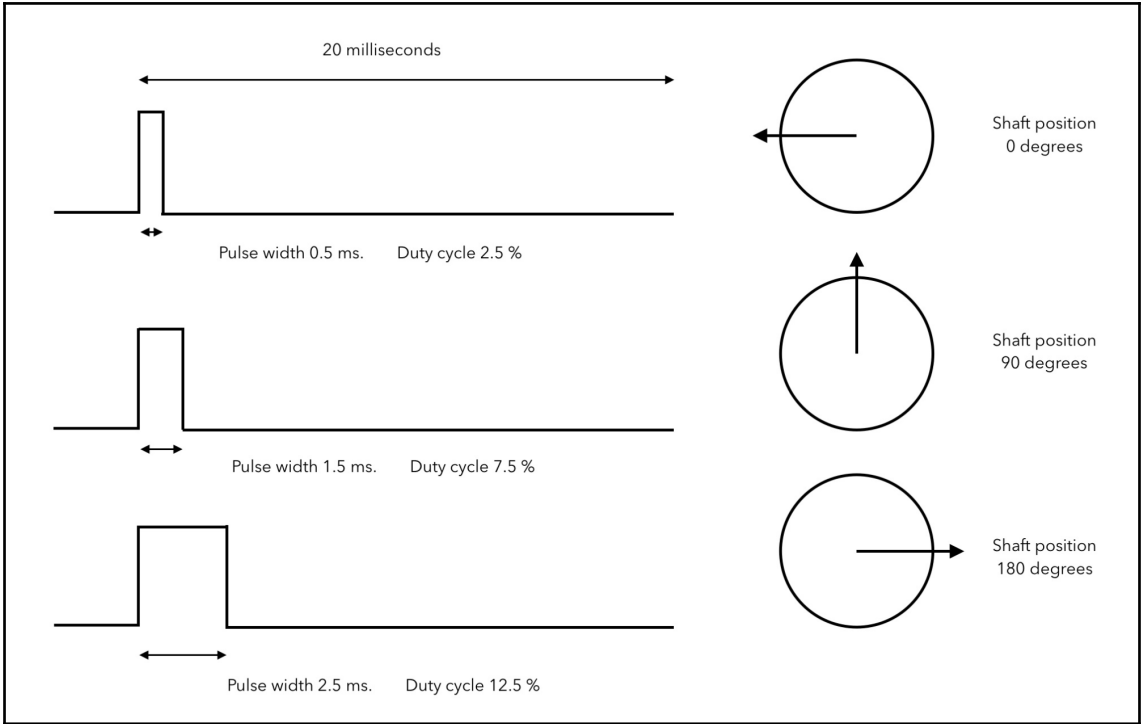
Chapter 8: Making Your Own Area Scanner

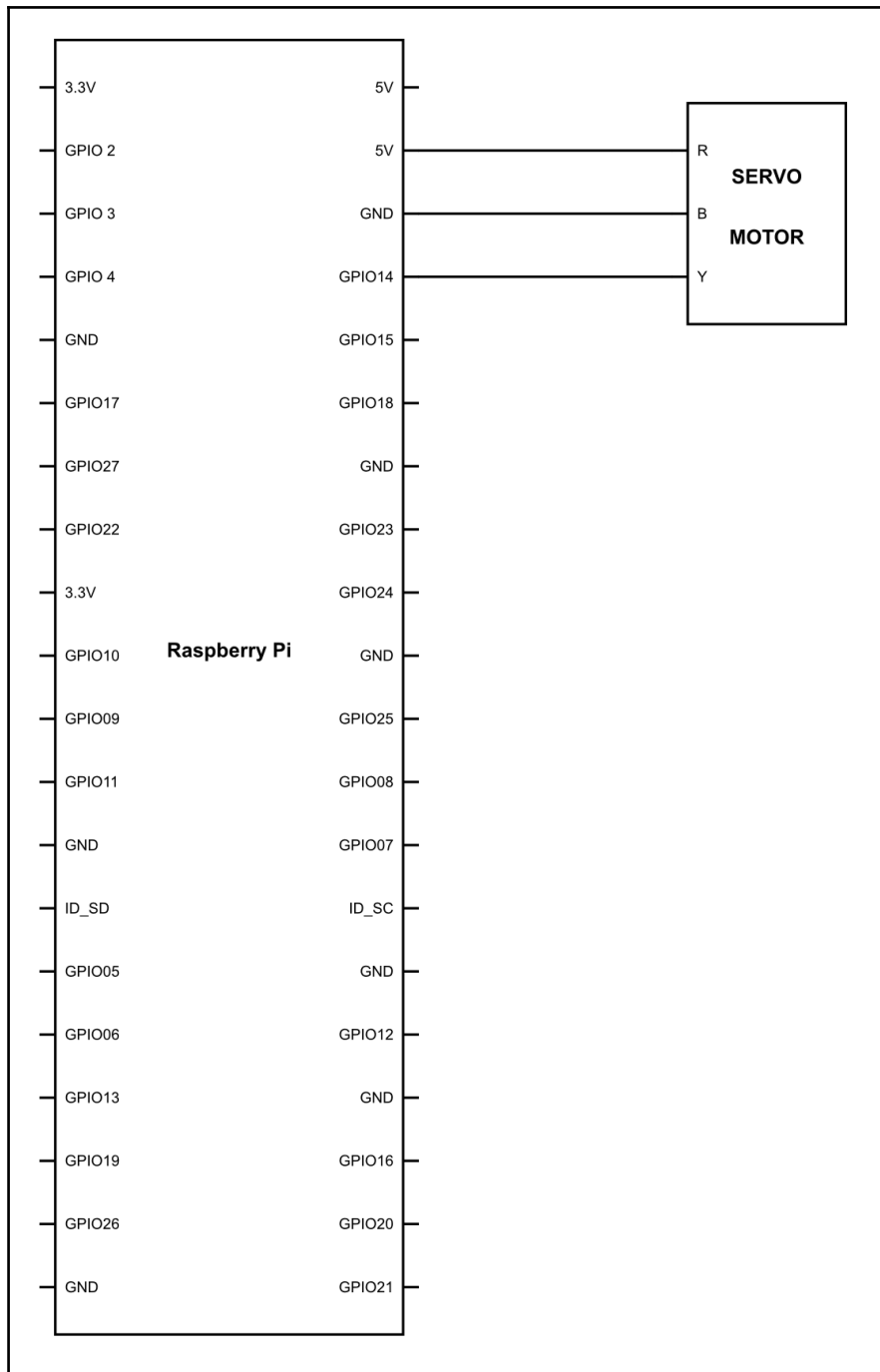


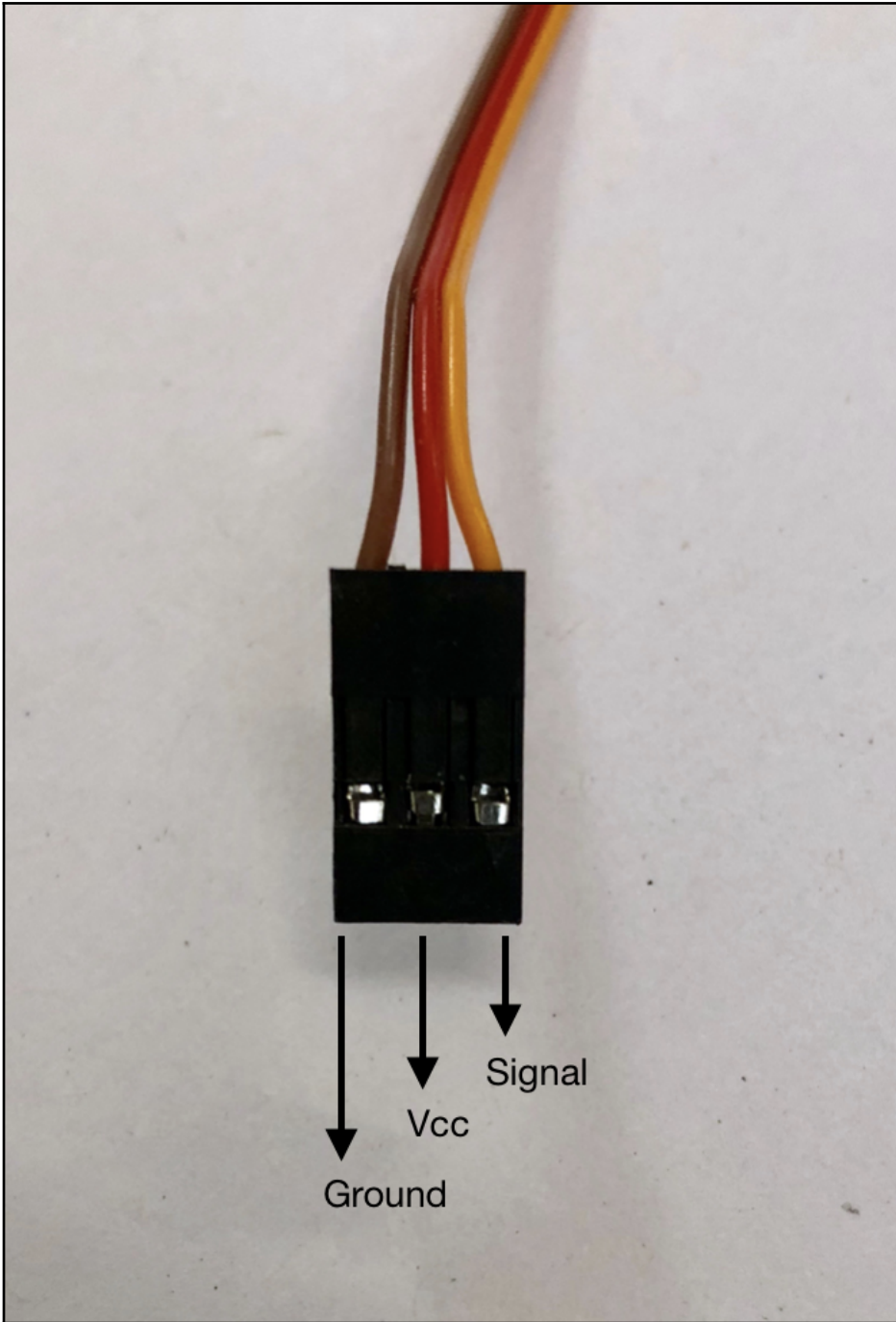


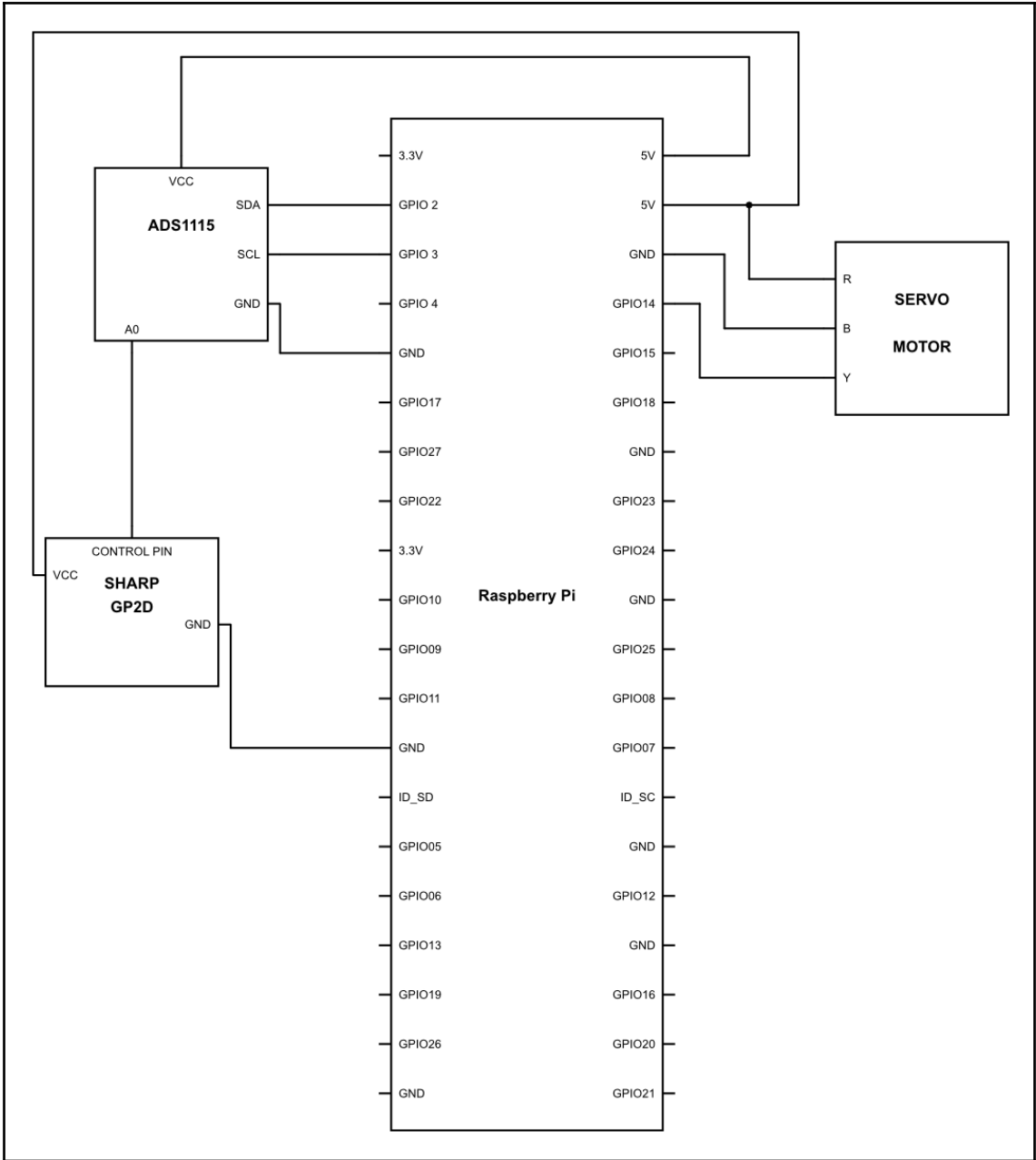


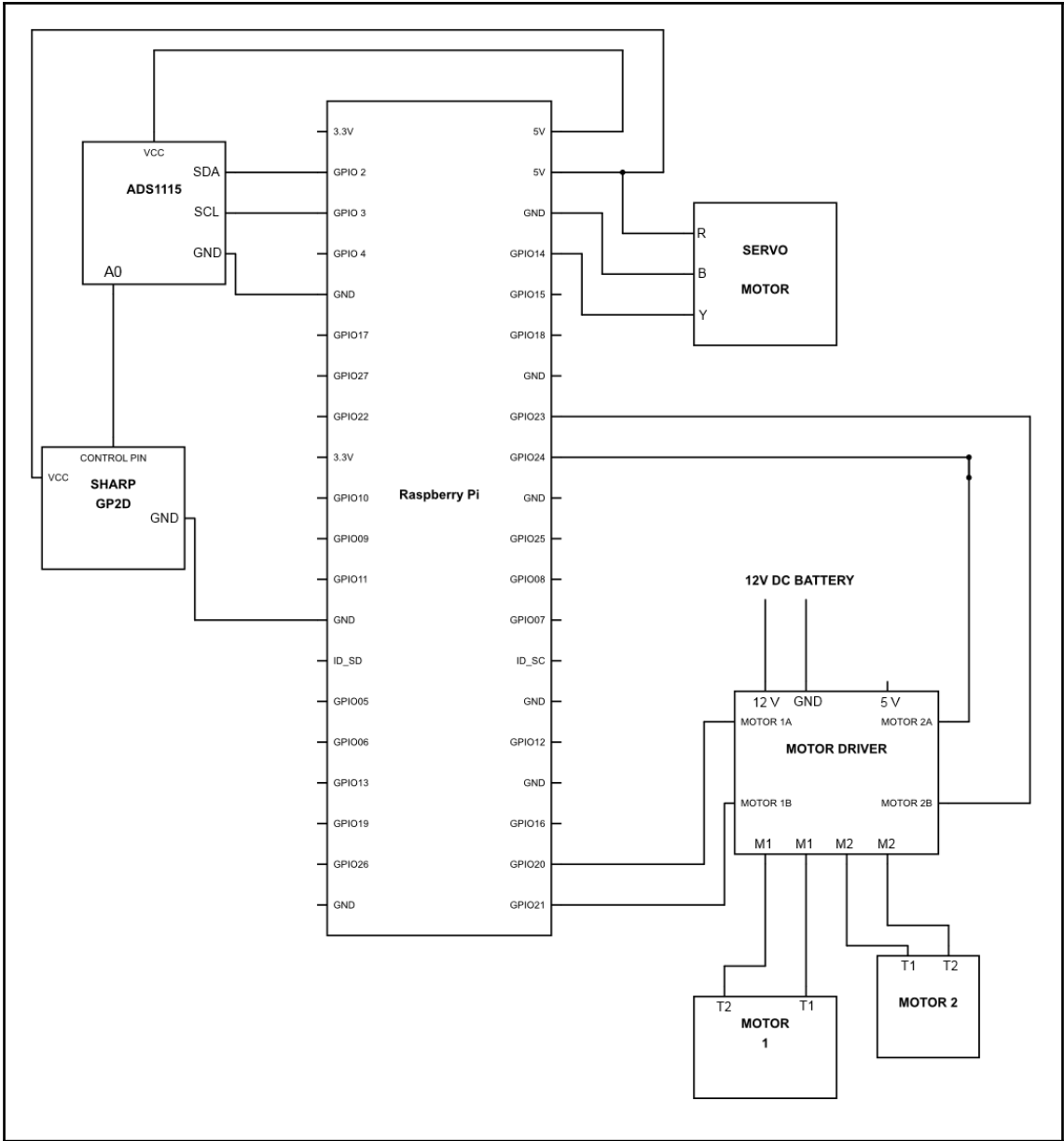












Chapter 9: Vision Processing

```
pi@raspberrypi:~ $ sudo apt-get update
Get:1 http://archive.raspberrypi.org/debian stretch InRelease [25.3 kB]
Get:2 http://raspbian.raspberrypi.org/raspbian stretch InRelease [15.0 kB]
Get:3 http://raspbian.raspberrypi.org/raspbian stretch/main armhf Packages [11.7 MB]
Get:4 http://archive.raspberrypi.org/debian stretch/main armhf Packages [159 kB]
Get:5 http://archive.raspberrypi.org/debian stretch/ui armhf Packages [30.8 kB]
Fetched 11.9 MB in 11s (1,030 kB/s)
Reading package lists... Done
pi@raspberrypi:~ $ sudo apt-get upgrade
Reading package lists... Done
Building dependency tree
Reading state information... Done
Calculating upgrade... Done
The following packages were automatically installed and are no longer required:
  lxkeymap python-cairo python-gobject python-gobject-2 python-gtk2 python-xklavier
Use 'sudo apt autoremove' to remove them.
The following packages have been kept back:
  chromium-browser rpi-chromium-mods
```

```
pi@raspberrypi:~ $ sudo rpi-update
*** Raspberry Pi firmware updater by Hexxeh, enhanced by AndrewS and Dom
*** Performing self-update
% Total    % Received % Xferd  Average Speed   Time    Time     Time  Current
   Dload  Upload  Total   Total    Spent    Left   Speed
100 13403  100 13403    0     0  16743    0  --:--:--  --:--:--  --:--:--  16732
*** Relaunching after update
*** Raspberry Pi firmware updater by Hexxeh, enhanced by AndrewS and Dom
*** We're running for the first time
*** Backing up files (this will take a few minutes)
*** Backing up firmware
*** Backing up modules 4.14.34-v7+
#####
This update bumps to rpi-4.14.y linux tree
Be aware there could be compatibility issues with some drivers
Discussion here:
https://www.raspberrypi.org/forums/viewtopic.php?f=29&t=197689
#####
*** Downloading specific firmware revision (this will take a few minutes)
% Total    % Received % Xferd  Average Speed   Time    Time     Time  Current
   Dload  Upload  Total   Total    Spent    Left   Speed
100   168    0   168    0     0    170    0  --:--:--  --:--:--  --:--:--   170
100 55.6M  100 55.6M    0     0  1865k    0  0:00:30  0:00:30  --:--:--  1464k
*** Updating firmware
*** Updating kernel modules
*** depmod 4.14.39+
*** depmod 4.14.39-v7+
*** Updating VideoCore libraries
*** Using HardFP libraries
*** Updating SDK
*** Running ldconfig
*** Storing current firmware revision
*** Deleting downloaded files
*** Syncing changes to disk
*** If no errors appeared, your firmware was successfully updated to 3b0fb6409c69c37502341bd8c9978e763527b281
*** A reboot is needed to activate the new firmware
pi@raspberrypi:~ $
```

```
pi@raspberrypi:~ $ sudo apt-get install build-essential git cmake pkg-config
Reading package lists... Done
Building dependency tree
Reading state information... Done
build-essential is already the newest version (12.3).
git is already the newest version (1:2.11.0-3+deb9u2).
pkg-config is already the newest version (0.29-4).
The following additional packages will be installed:
  cmake-data libjsoncpp1
```

```
pi@raspberrypi:~ $ sudo apt-get install libxvidcore-dev libx264-dev
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following packages were automatically installed and are no longer required:
  libjpeg8 libpng-tools
Use 'sudo apt autoremove' to remove them.
The following NEW packages will be installed:
  libx264-dev libxvidcore-dev
0 upgraded, 2 newly installed, 0 to remove and 1 not upgraded.
```

```
pi@raspberrypi:~ $ sudo apt-get install libjpeg8-dev
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following additional packages will be installed:
  libjpeg8
The following NEW packages will be installed:
  libjpeg8 libjpeg8-dev
```

```
pi@raspberrypi:~ $ sudo apt-get install libtiff5-dev
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following package was automatically installed and is no longer required:
  libjpeg8
Use 'sudo apt autoremove' to remove it.
The following additional packages will be installed:
  libjbig-dev libjpeg-dev libjpeg62-turbo-dev liblzma-dev libtiffxx5
Suggested packages:
  liblzma-doc
The following packages will be REMOVED:
  libjpeg8-dev
```

```
pi@raspberrypi:~ $ sudo apt-get install libjasper-dev
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following packages were automatically installed and are no longer required:
  libjpeg8 lxkeymap python-cairo python-gobject python-gobject-2 python-gtk2 python-xklavier
Use 'sudo apt autoremove' to remove them.
The following additional packages will be installed:
  libjasper1
```

```
pi@raspberrypi:~ $ sudo apt-get install libpng12-dev
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following packages were automatically installed and are no longer required:
  libjpeg8 libpng-tools lxkeymap python-cairo python-gobject python-gobject-2 python-gtk2 python-xklavier
Use 'sudo apt autoremove' to remove them.
The following packages will be REMOVED:
  libfreetype6-dev libpng-dev
The following NEW packages will be installed:
  libpng12-dev
```

```
pi@raspberrypi:~ $ sudo apt-get install libgtk-3-dev
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following package was automatically installed and is no longer required:
  libjpeg8
Use 'sudo apt autoremove' to remove it.
```

```
pi@raspberrypi:~ $ sudo apt-get install libatlas-base-dev gfortran
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following packages were automatically installed and are no longer required:
  libjpeg8 lxkeymap python-cairo python-gobject python-gobject-2 python-gtk2 python-xklavier
Use 'sudo apt autoremove' to remove them.
The following additional packages will be installed:
  gfortran-6 libatlas-dev libatlas3-base libblas-dev libgfortran-6-dev
```

```
pi@raspberrypi:~ $ sudo apt-get install python2.7-dev python3-dev
Reading package lists... Done
Building dependency tree
Reading state information... Done
python2.7-dev is already the newest version (2.7.13-2+deb9u2).
python3-dev is already the newest version (3.5.3-1).
The following packages were automatically installed and are no longer required:
  libjpeg8 lxkeymap python-cairo python-gobject python-gobject-2 python-gtk2
  python-xklavier
Use 'sudo apt autoremove' to remove them.
0 upgraded, 0 newly installed, 0 to remove and 2 not upgraded.
pi@raspberrypi:~ $ █
```

```
pi@raspberrypi:~ $ cd ~
pi@raspberrypi:~ $ wget -O opencv.zip https://github.com/Itseez/opencv/archive/3.4.0.zip
--2018-03-20 08:47:43-- https://github.com/Itseez/opencv/archive/3.4.0.zip
Resolving github.com (github.com)... 192.30.253.112, 192.30.253.113
Connecting to github.com (github.com)|192.30.253.112|:443... connected.
HTTP request sent, awaiting response... 301 Moved Permanently
Location: https://github.com/opencv/opencv/archive/3.4.0.zip [following]
--2018-03-20 08:47:44-- https://github.com/opencv/opencv/archive/3.4.0.zip
Reusing existing connection to github.com:443.
HTTP request sent, awaiting response... 302 Found
```

```
pi@raspberrypi:~ $ unzip opencv.zip
```

```
pi@raspberrypi:~ $ unzip opencv.zip
```

```
pi@raspberrypi:~ $ wget -O opencv_contrib.zip https://github.com/Itseez/opencv_contrib/archive/3.4.0.zip
--2018-03-20 09:15:16-- https://github.com/Itseez/opencv_contrib/archive/3.4.0.zip
Resolving github.com (github.com)... 192.30.253.112, 192.30.253.113
Connecting to github.com (github.com)|192.30.253.112|:443... connected.
HTTP request sent, awaiting response... 301 Moved Permanently
Location: https://github.com/opencv/opencv_contrib/archive/3.4.0.zip [following]
--2018-03-20 09:15:17-- https://github.com/opencv/opencv_contrib/archive/3.4.0.zip
Reusing existing connection to github.com:443.
HTTP request sent, awaiting response... 302 Found
```

```
pi@raspberrypi:~ $ unzip opencv_contrib.zip
```

```
pi@raspberrypi:~ $ cd ~
pi@raspberrypi:~ $ wget https://bootstrap.pypa.io/get-pip.py
--2018-03-20 09:19:54-- https://bootstrap.pypa.io/get-pip.py
Resolving bootstrap.pypa.io (bootstrap.pypa.io)... 151.101.8.175
Connecting to bootstrap.pypa.io (bootstrap.pypa.io)|151.101.8.175|:443...
HTTP request sent, awaiting response... 200 OK
Length: 1780410 (1.7M) [text/x-python]
Saving to: 'get-pip.py'
```

```
pi@raspberrypi:~ $ sudo python get-pip.py
Collecting pip
  Downloading pip-9.0.2-py2.py3-none-any.whl (1.4MB)
    100% |#####| 1.4MB 64kB/s
Installing collected packages: pip
  Found existing installation: pip 9.0.1
  Uninstalling pip-9.0.1:
    Successfully uninstalled pip-9.0.1
  Successfully installed pip-9.0.2
pi@raspberrypi:~ $ sudo pip install virtualenv virtualenvwrapper
```

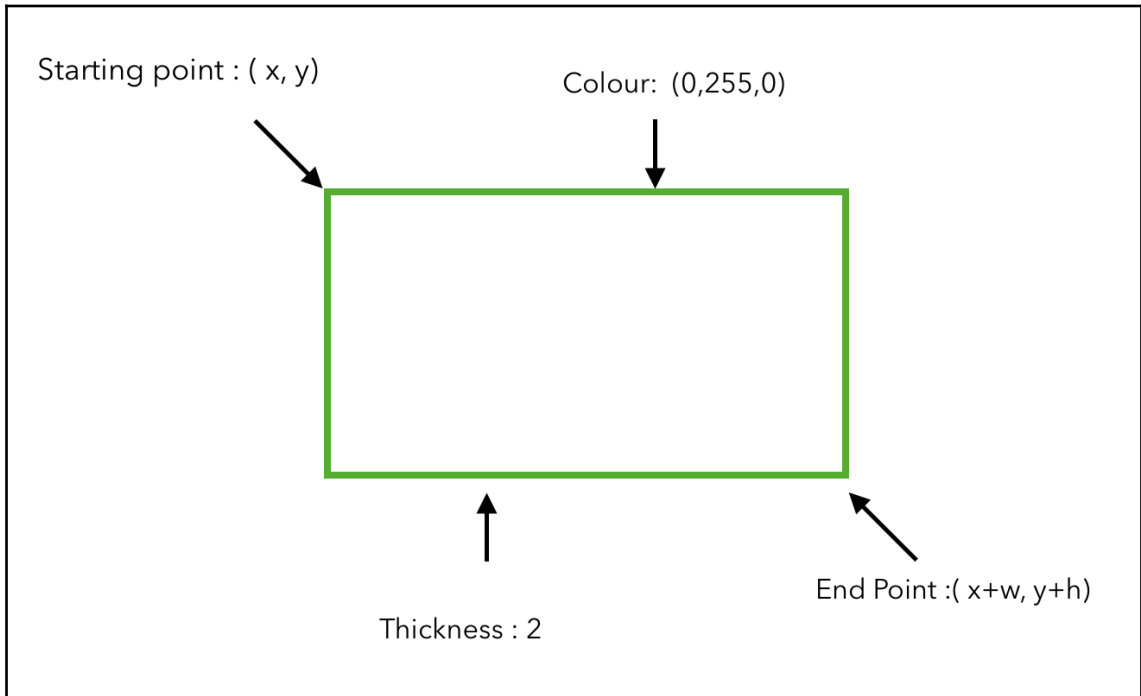
```
pi@raspberrypi:~ $ sudo rm -rf ~/get-pip.py ~/.cache/pip
```

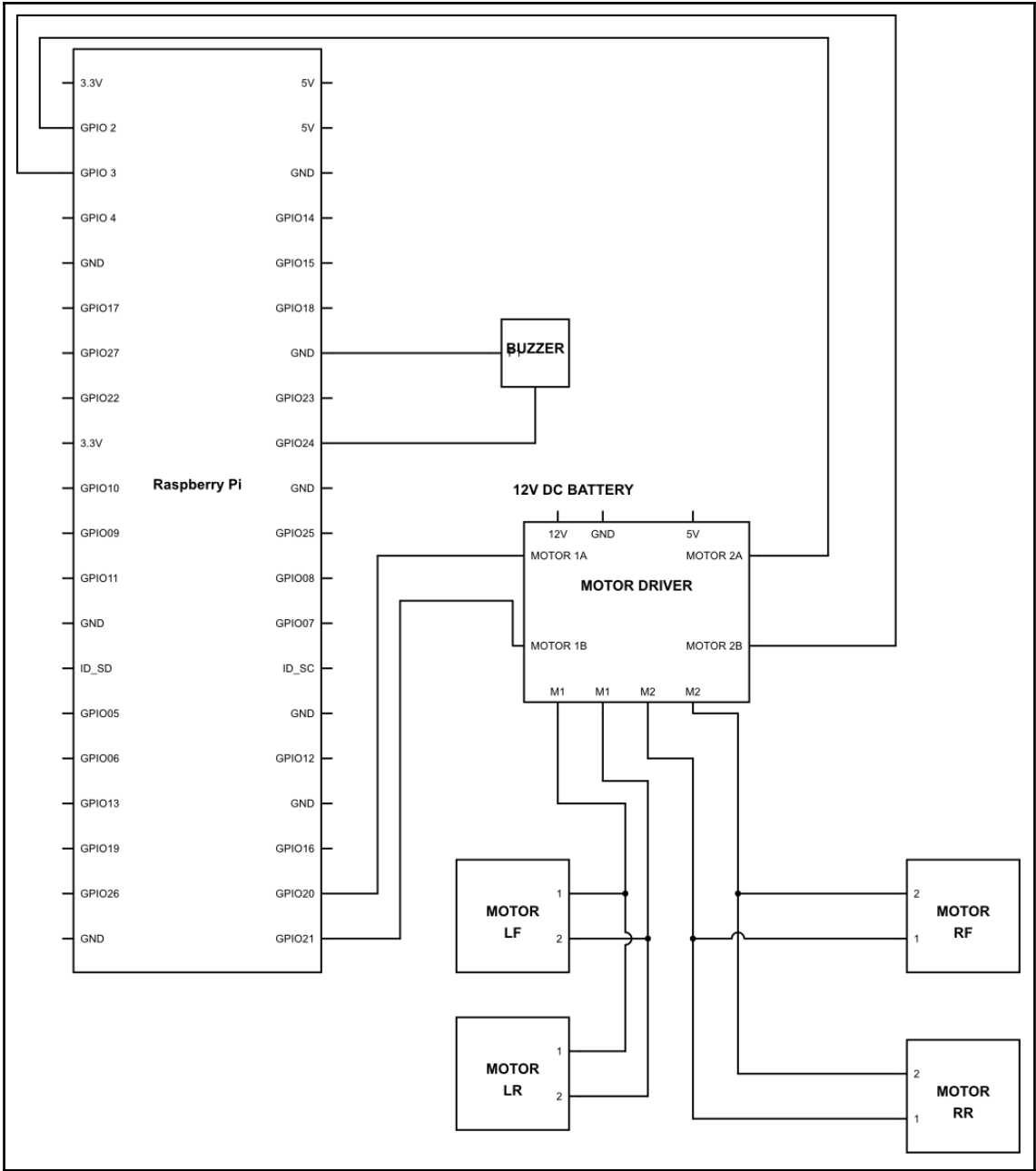
```
# virtualenv and virtualenvwrapper
export WORKON_HOME=$HOME/.virtualenvs
source /usr/local/bin/virtualenvwrapper.sh
```

```
(cv) pi@raspberrypi:~/opencv-3.4.0/build $ sudo ldconfig
(cv) pi@raspberrypi:~/opencv-3.4.0/build $ ls -l /usr/local/lib/python2.7/site-packages/
total 4432
-rw-r--r-- 1 root staff 4534312 Mar 21 04:40 cv2.so
(cv) pi@raspberrypi:~/opencv-3.4.0/build $ cd ~/.virtualenvs/cv/lib/python2.7/site-packages/
(cv) pi@raspberrypi:~/.virtualenvs/cv/lib/python2.7/site-packages $ ln -s /usr/local/lib/python2.7/site-packages/cv2.so cv2.so
(cv) pi@raspberrypi:~/.virtualenvs/cv/lib/python2.7/site-packages $
```

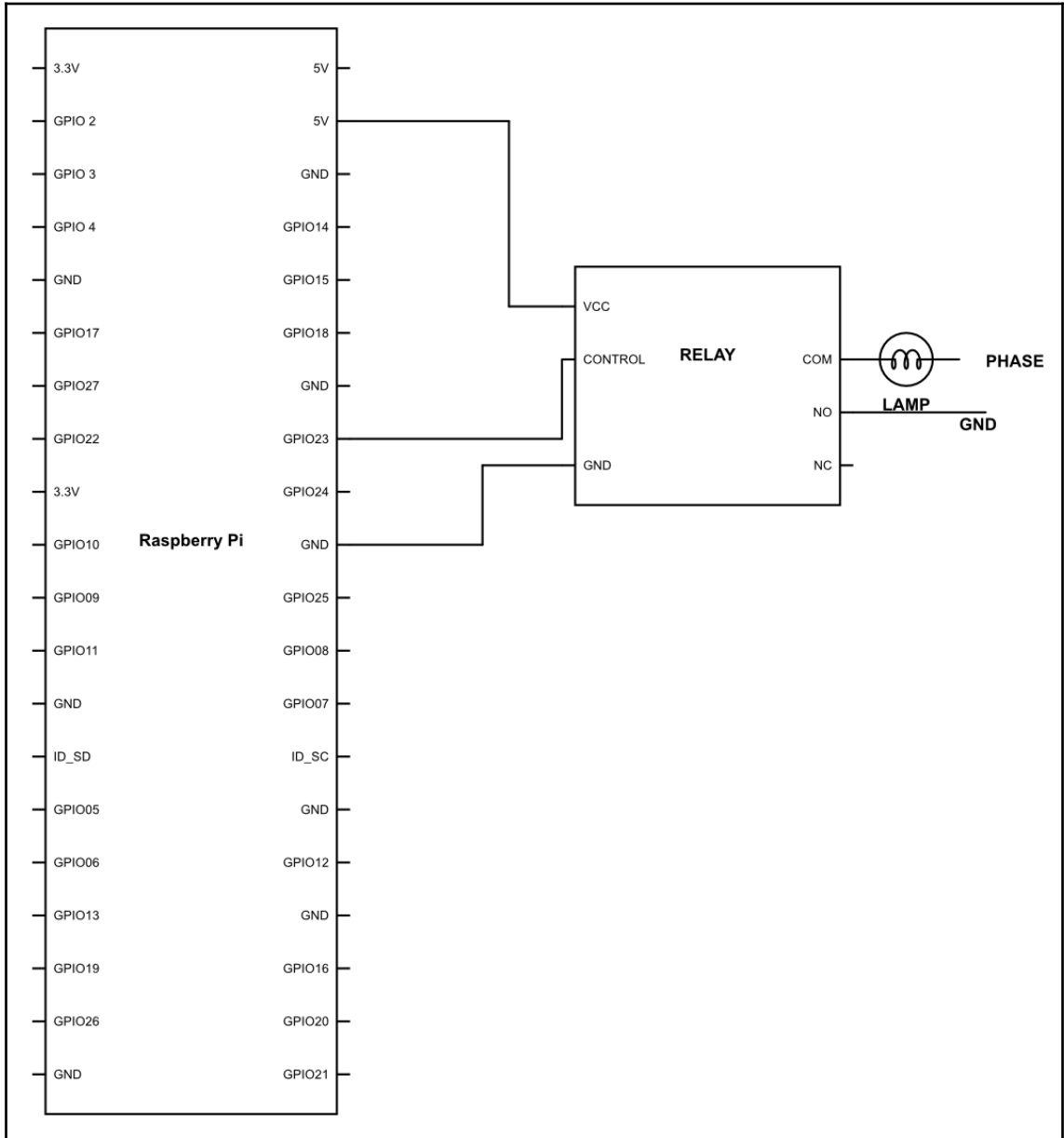
```
pi@raspberrypi: ~
File Edit Tabs Help
pi@raspberrypi:~ $ workon cv
(cv) pi@raspberrypi:~ $ python
Python 2.7.13 (default, Nov 24 2017, 17:33:09)
[GCC 6.3.0 20170516] on linux2
Type "help", "copyright", "credits" or "license" for more information.
>>> import cv2
>>> cv2.__version__
'3.4.0'
>>>
```

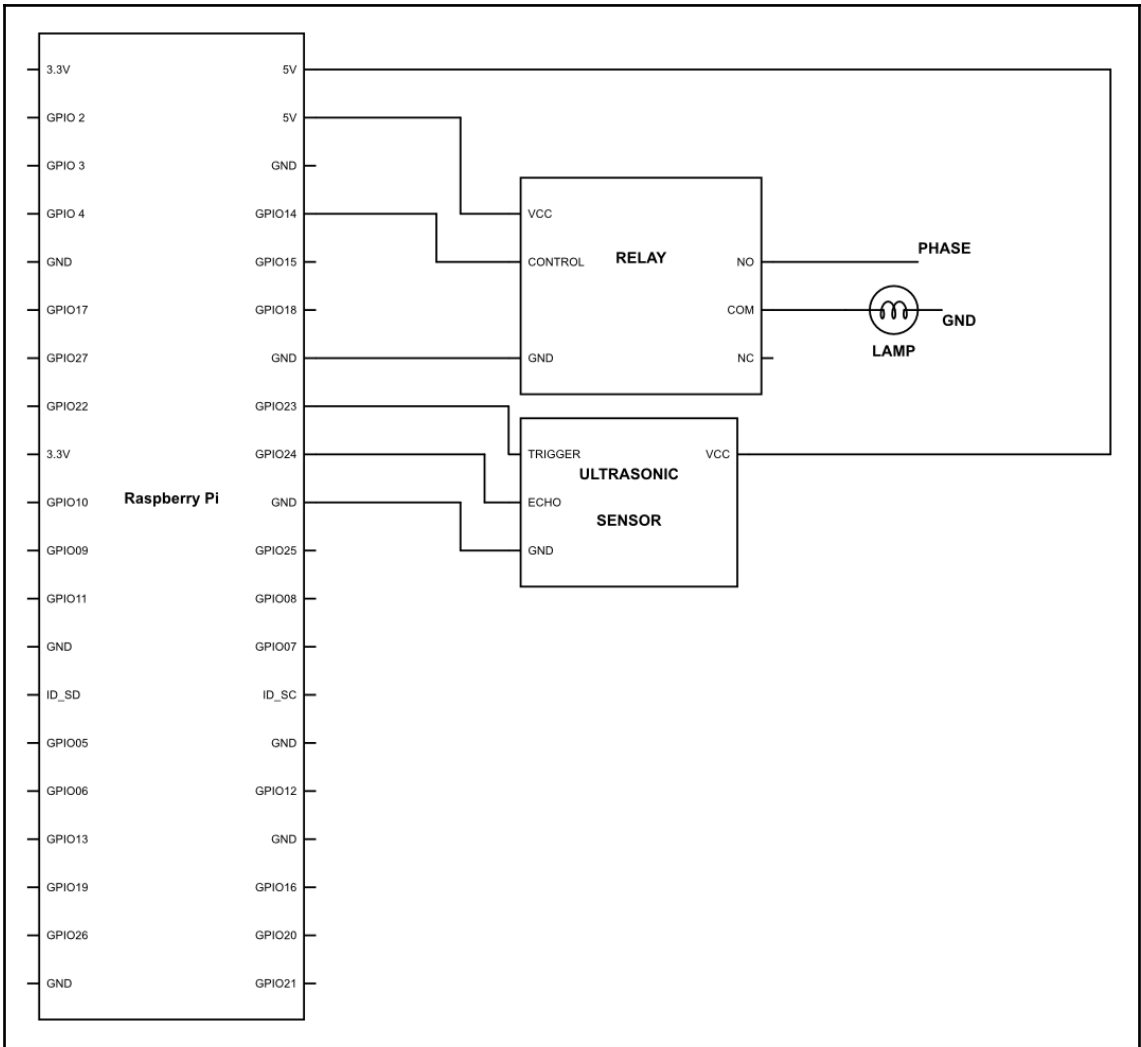
Chapter 10: Making a Guard Robot

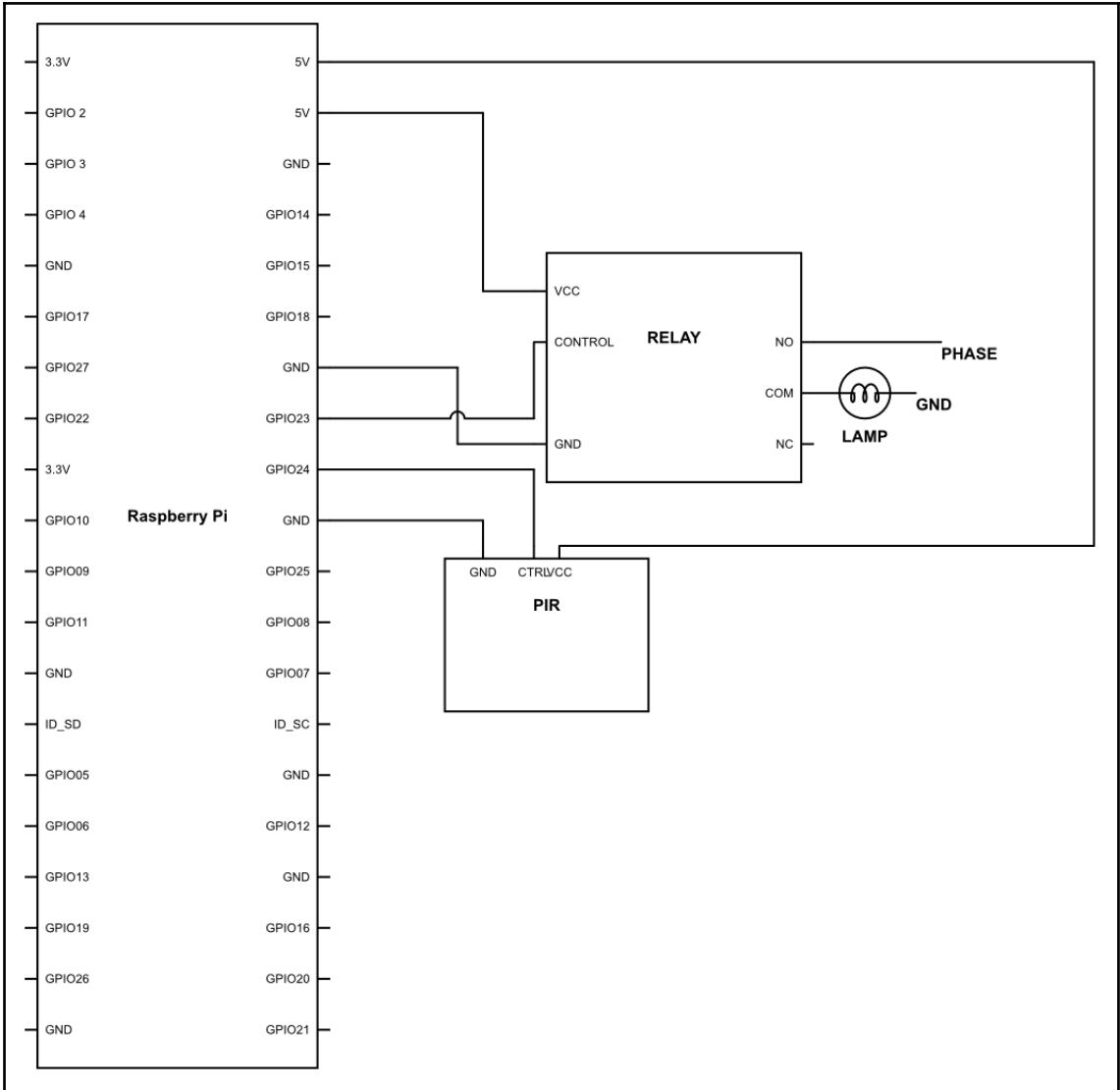




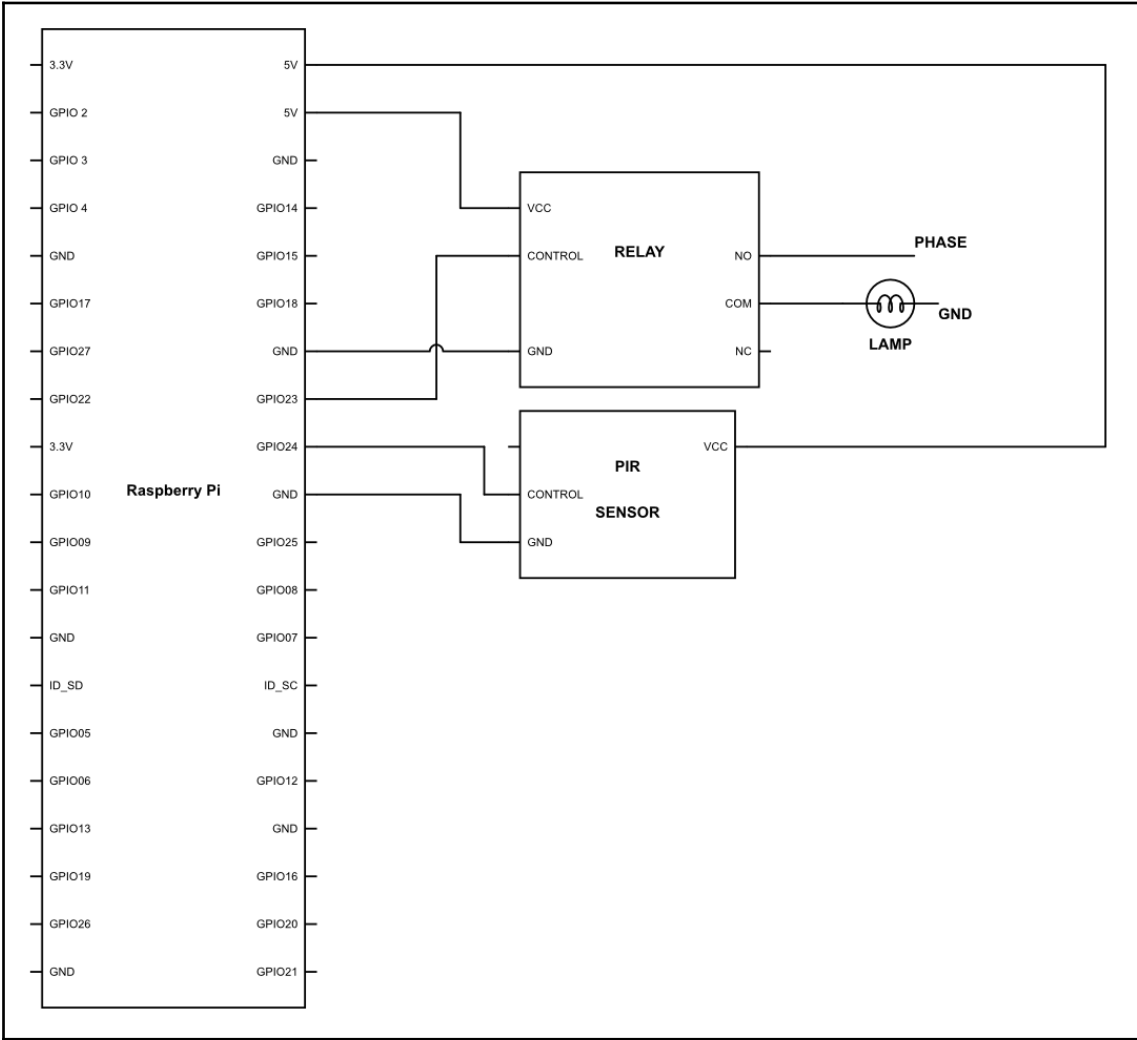
Chapter 11: Basic Switching

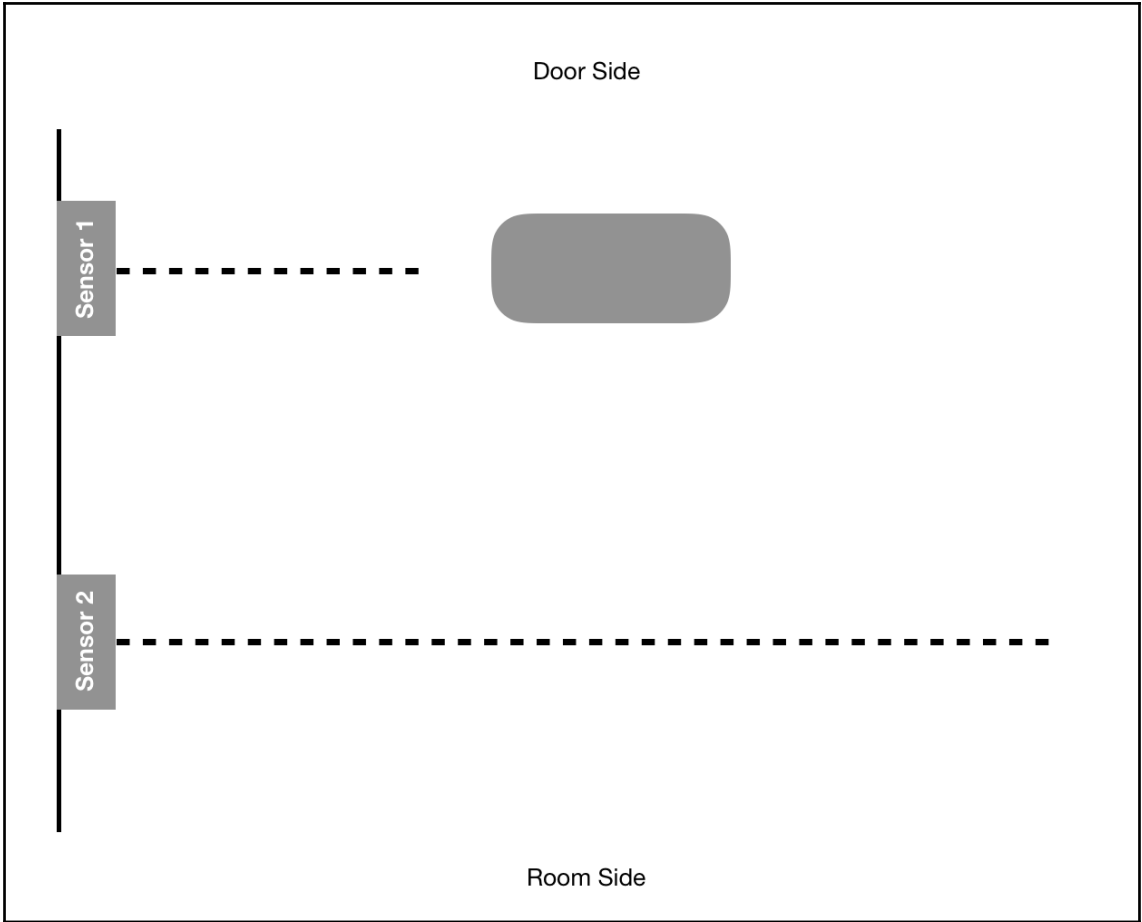


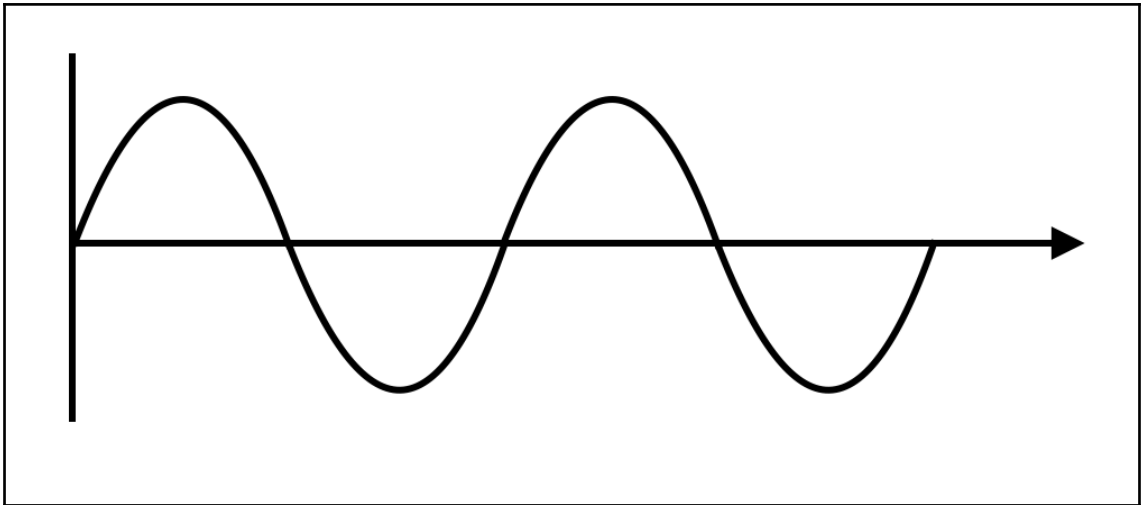
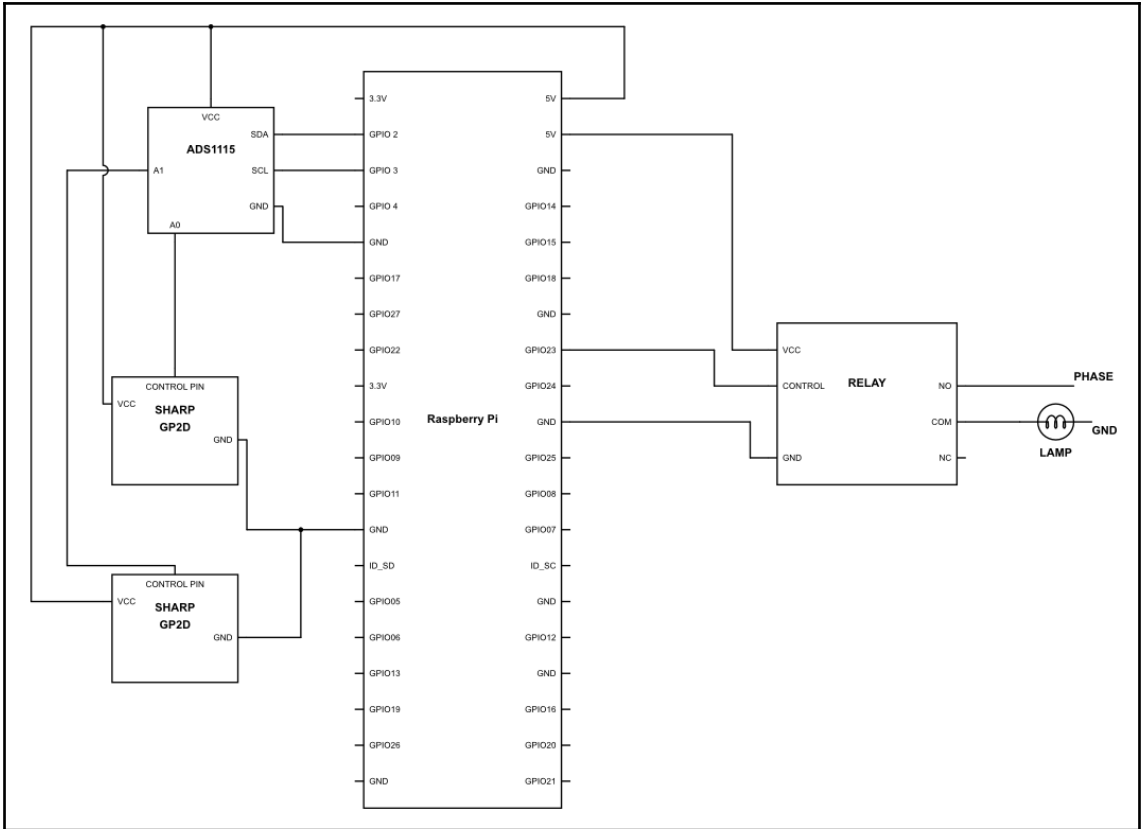


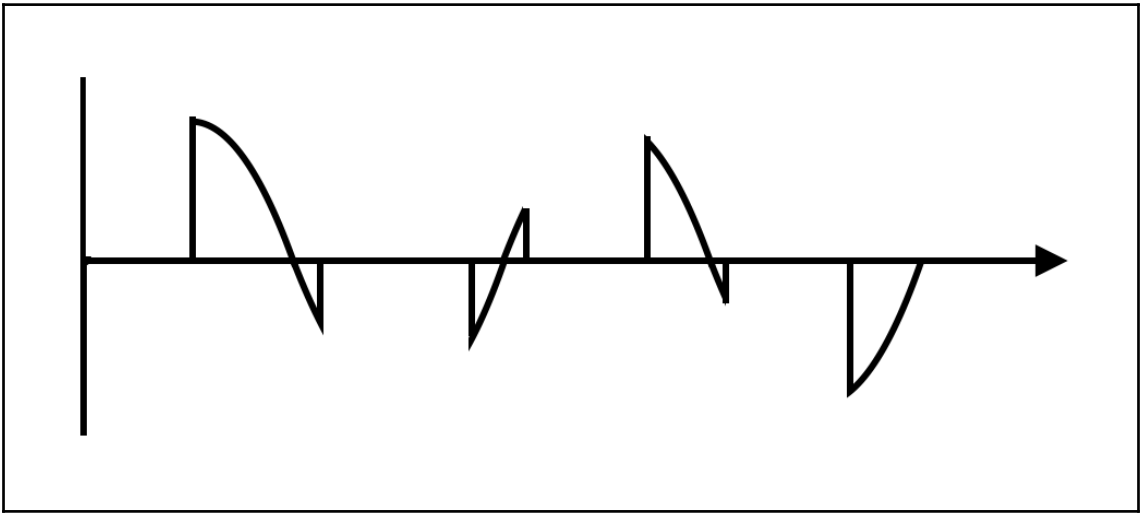
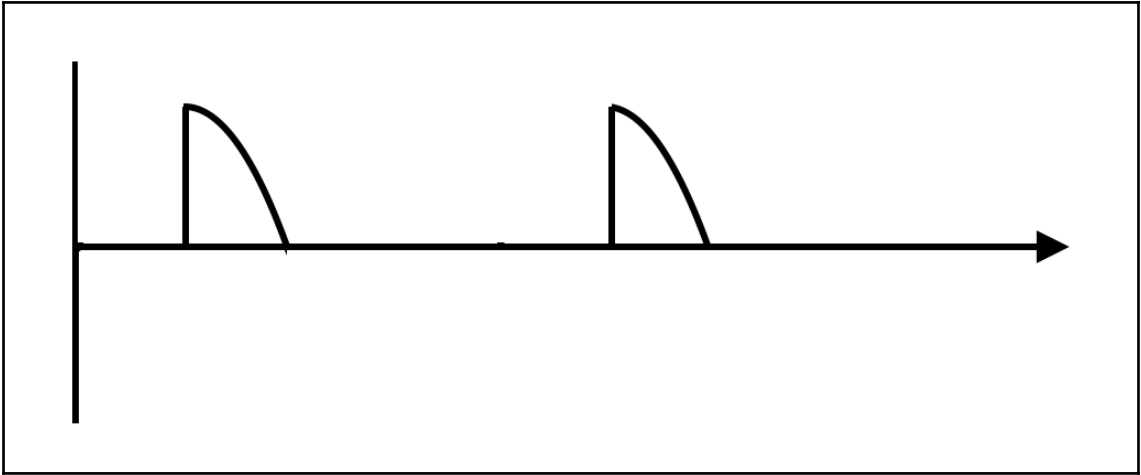


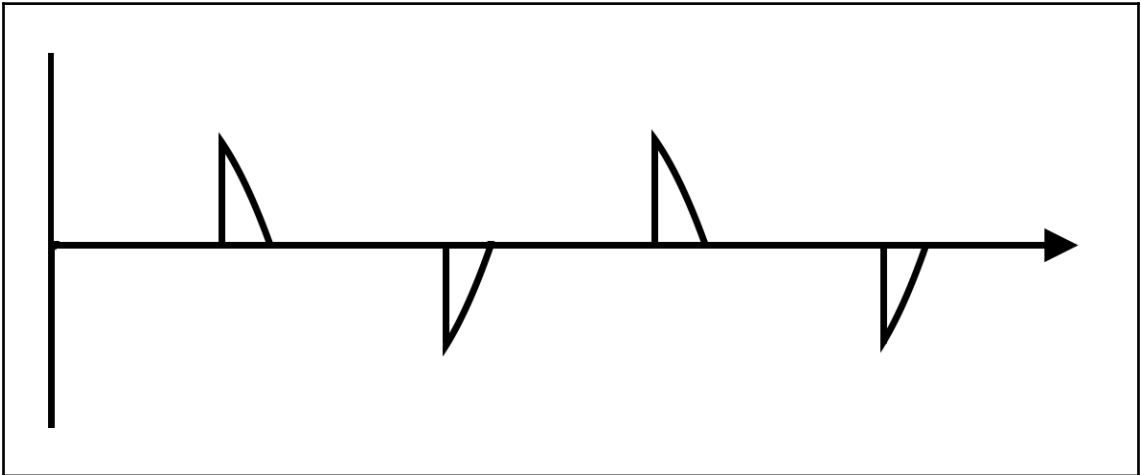
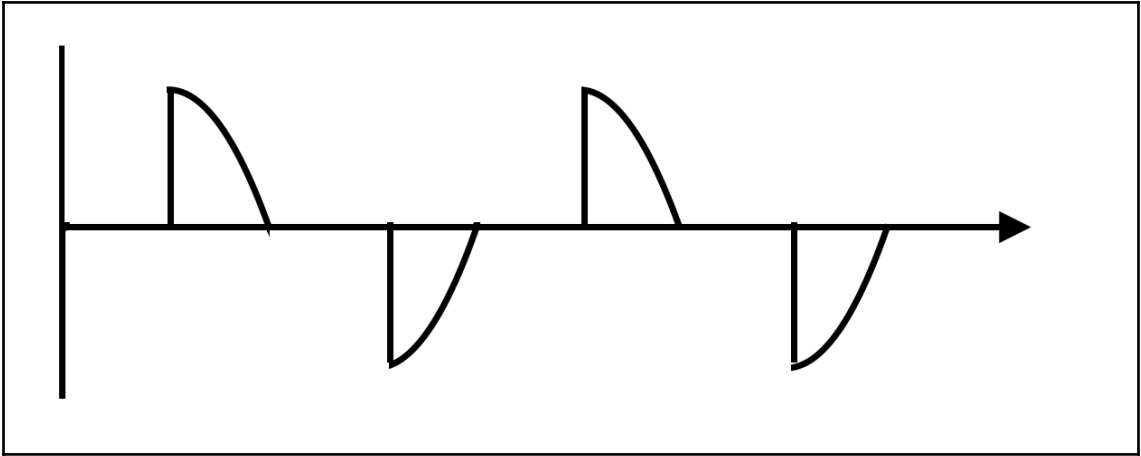
Chapter 12: Recognizing Humans with Jarvis

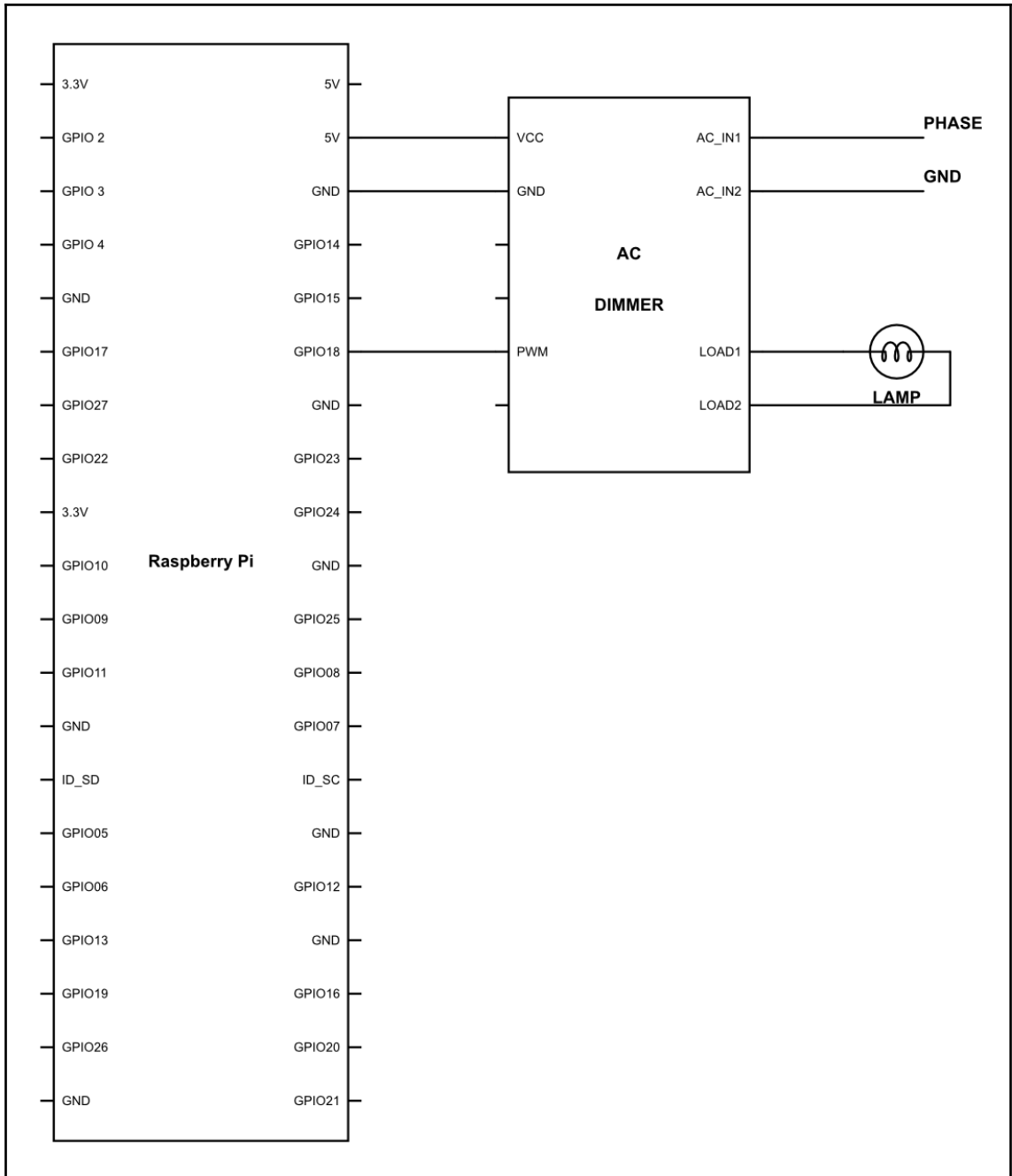


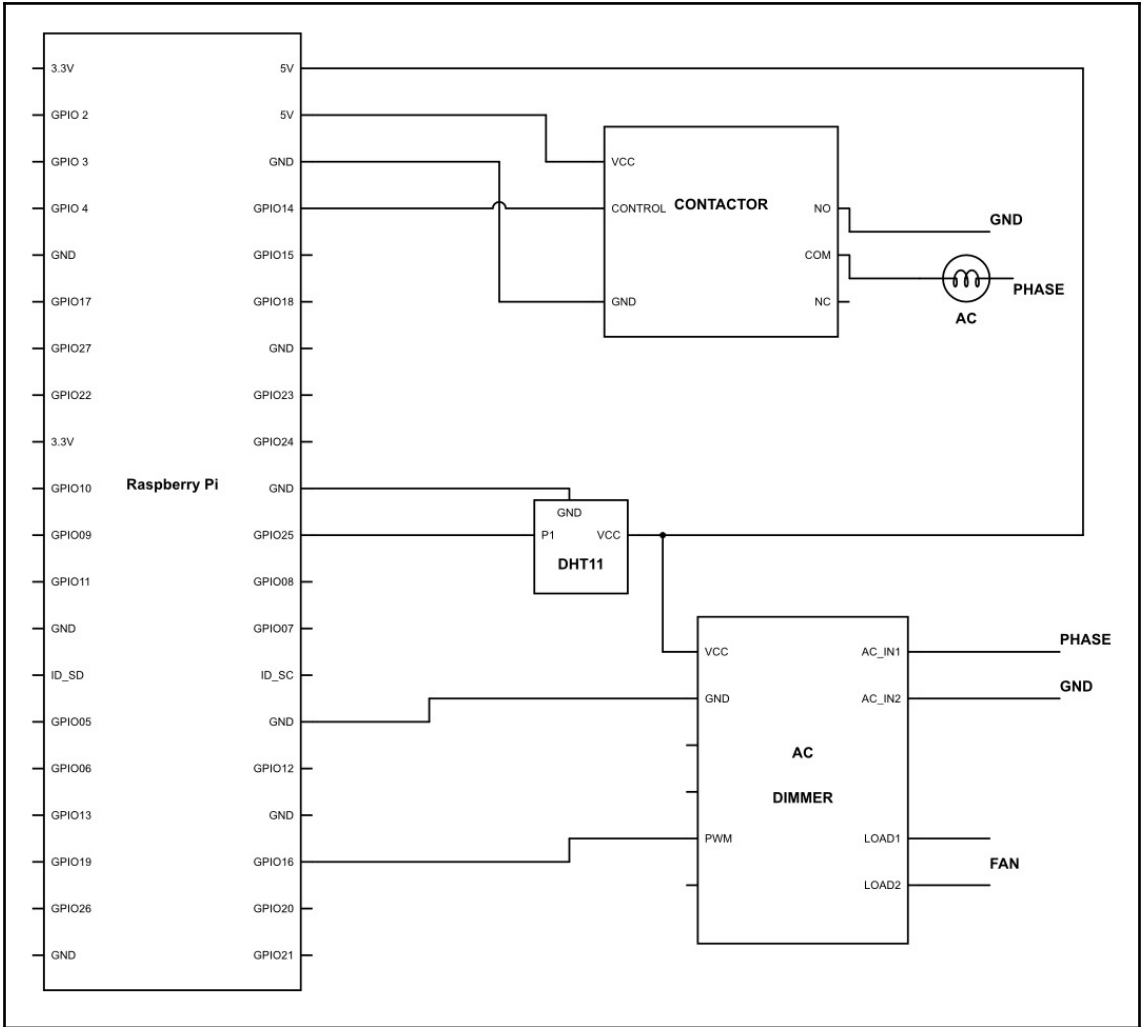


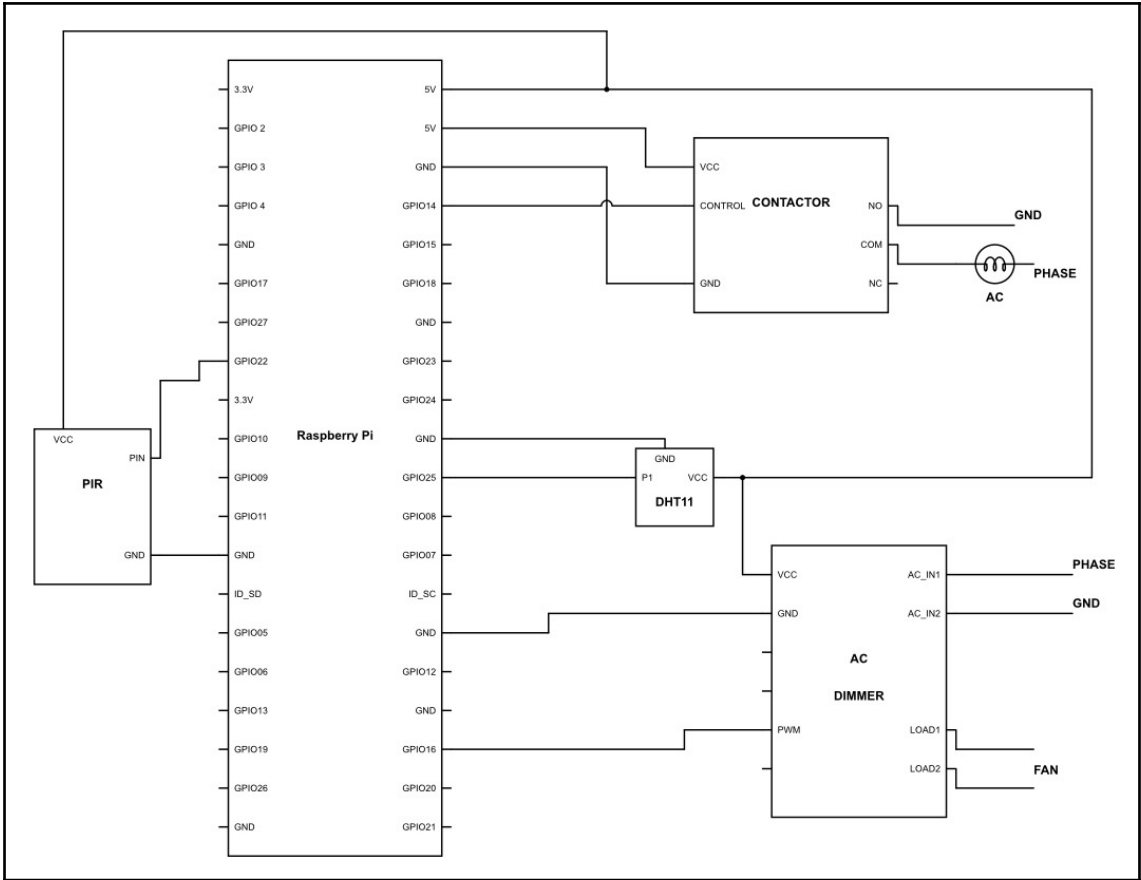


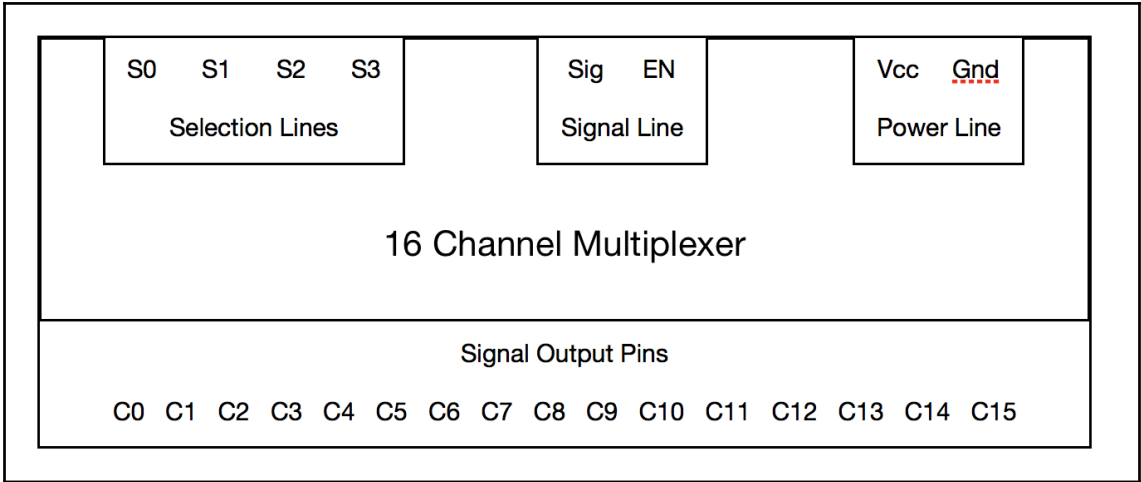


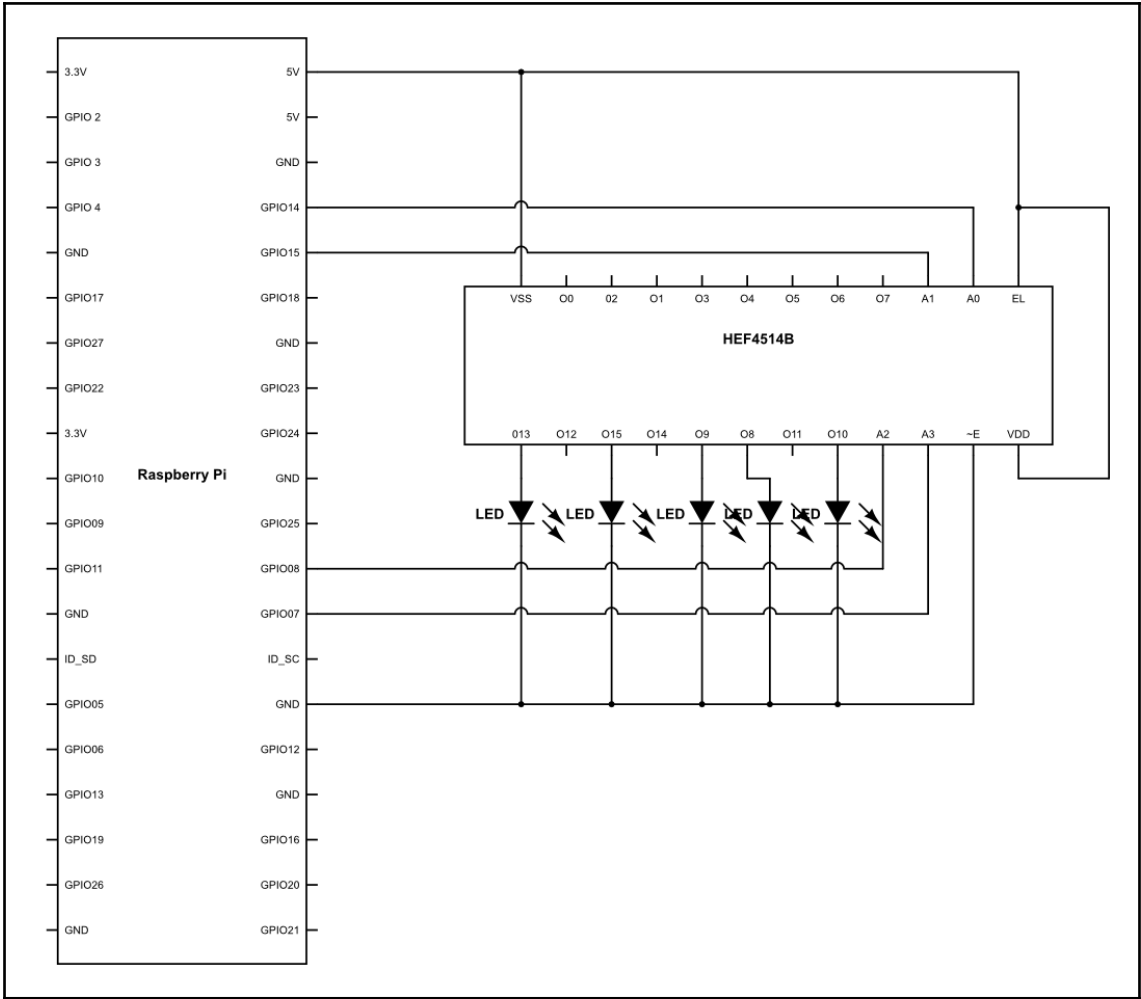




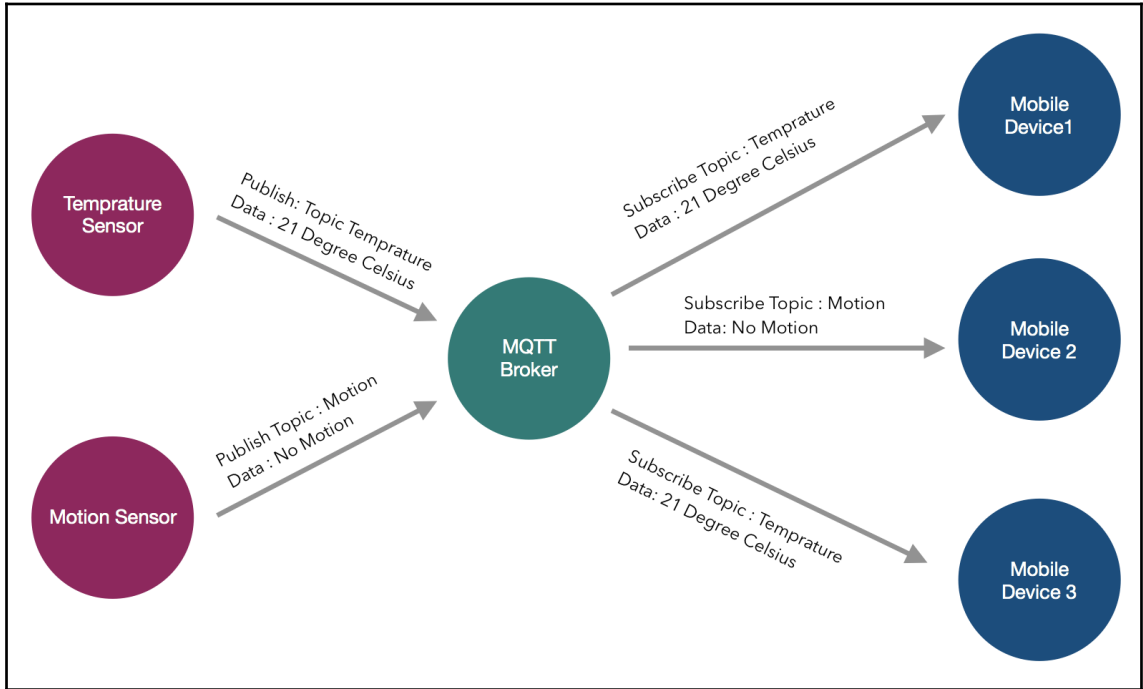


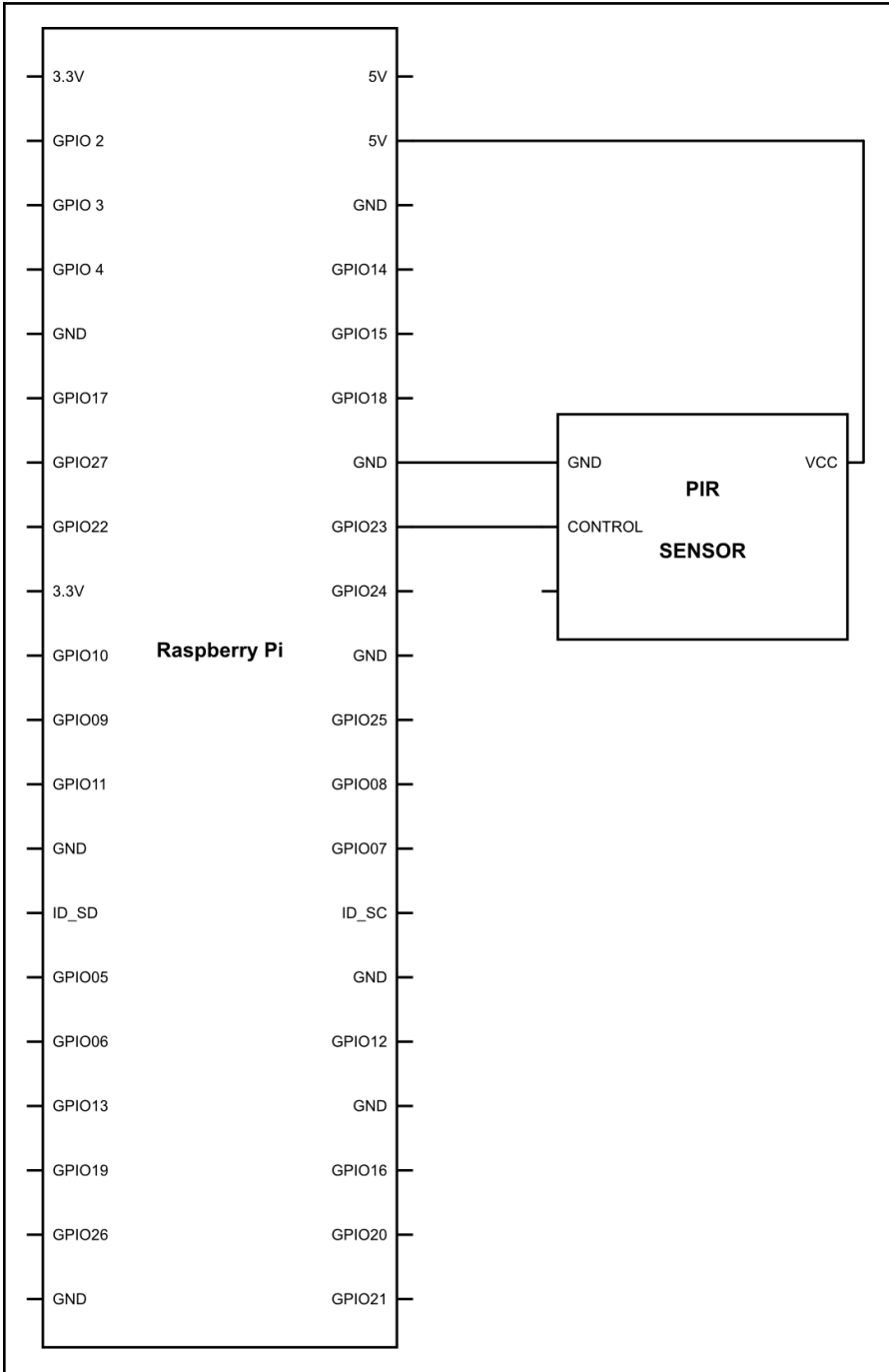






Chapter 13: Making Jarvis IoT Enabled







Settings



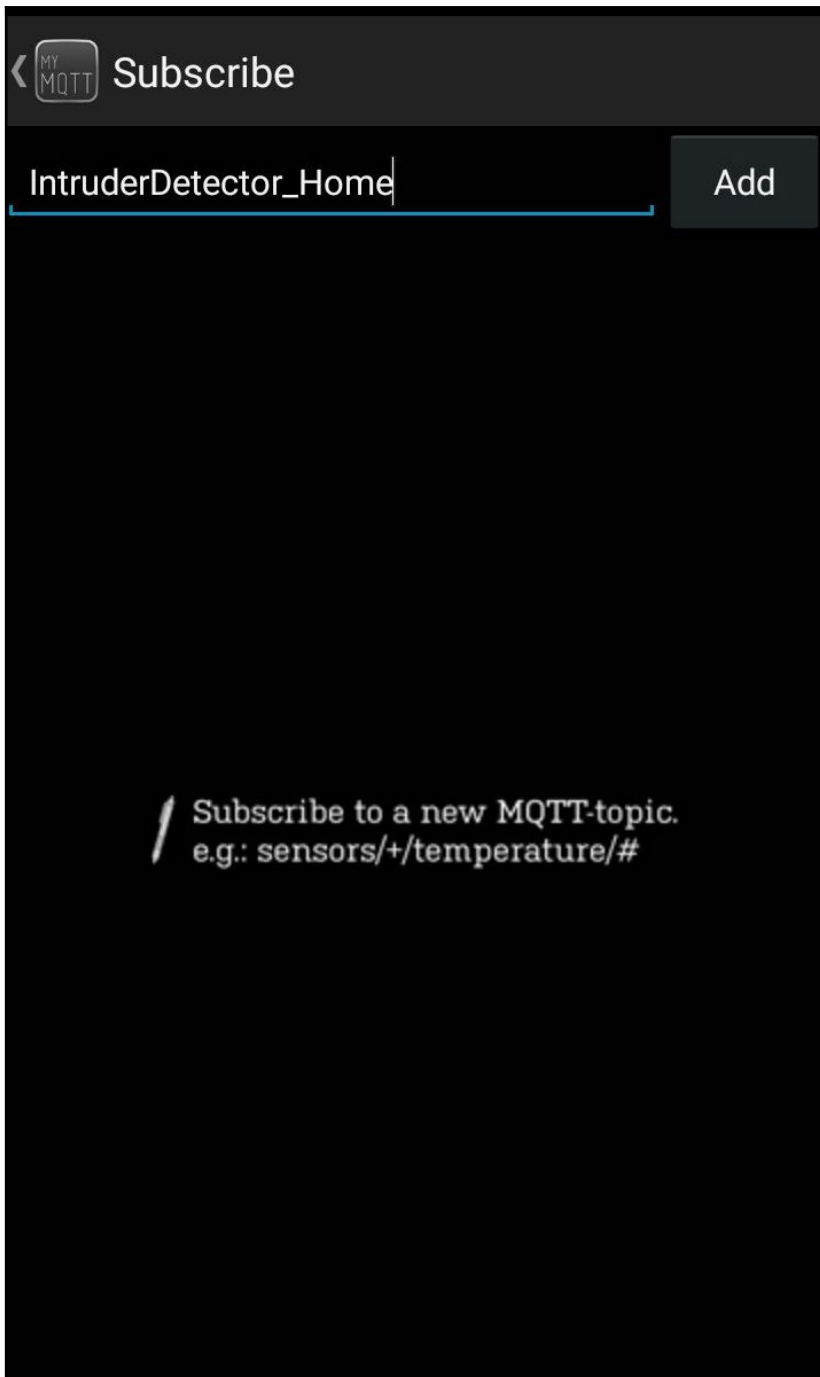
broker.hivemq.com

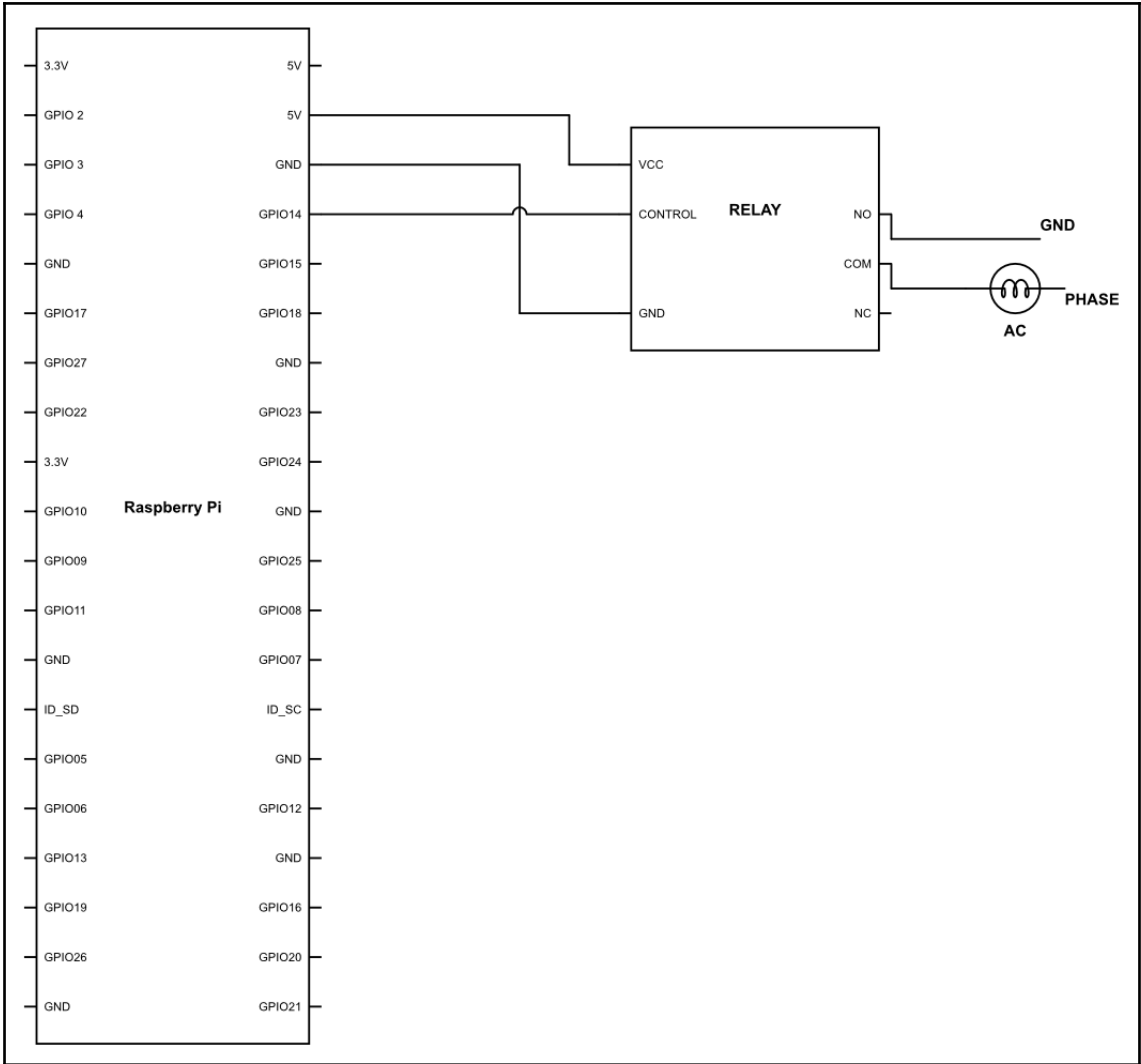
1883

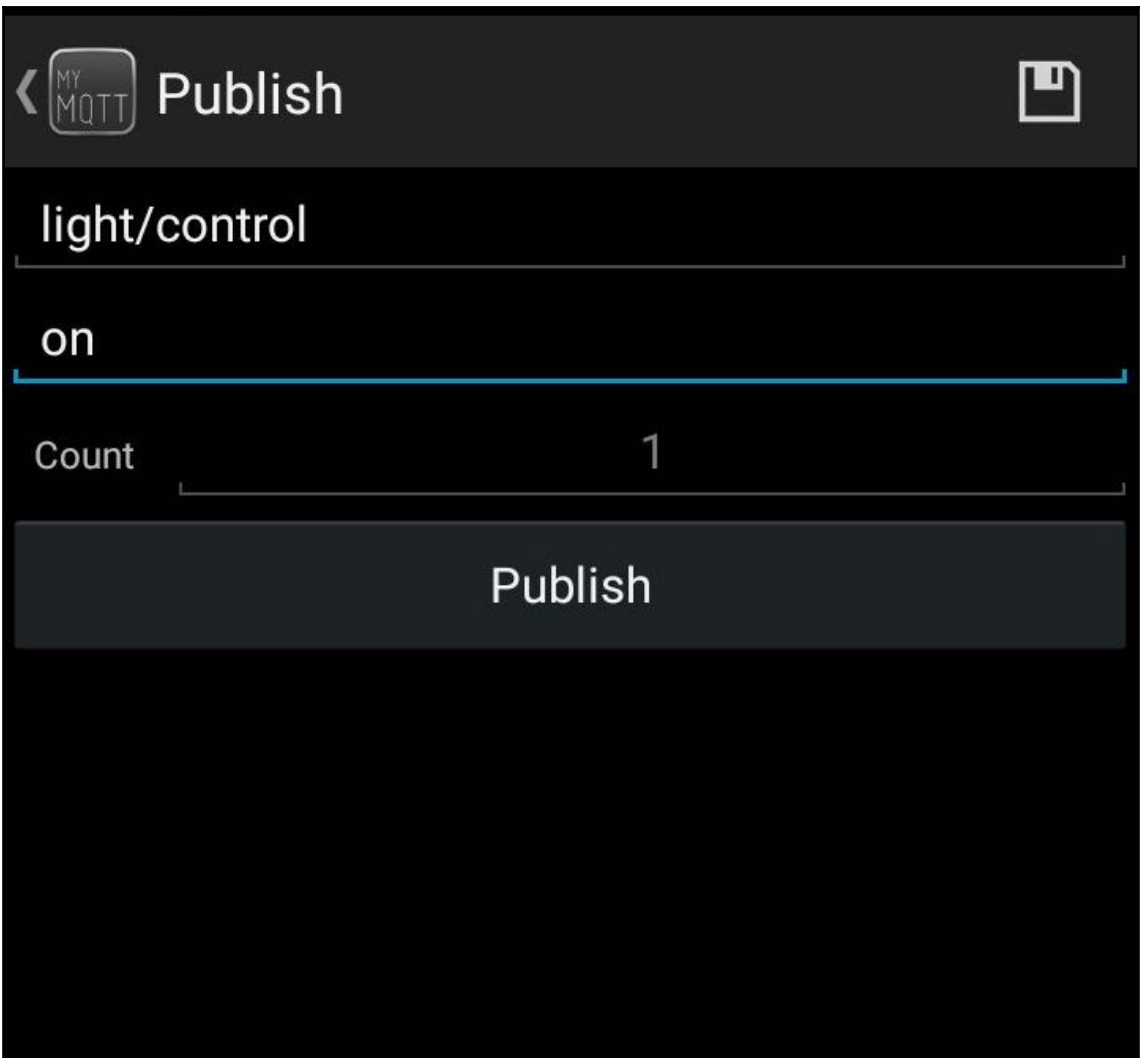
Username (optional)

Password (optional)

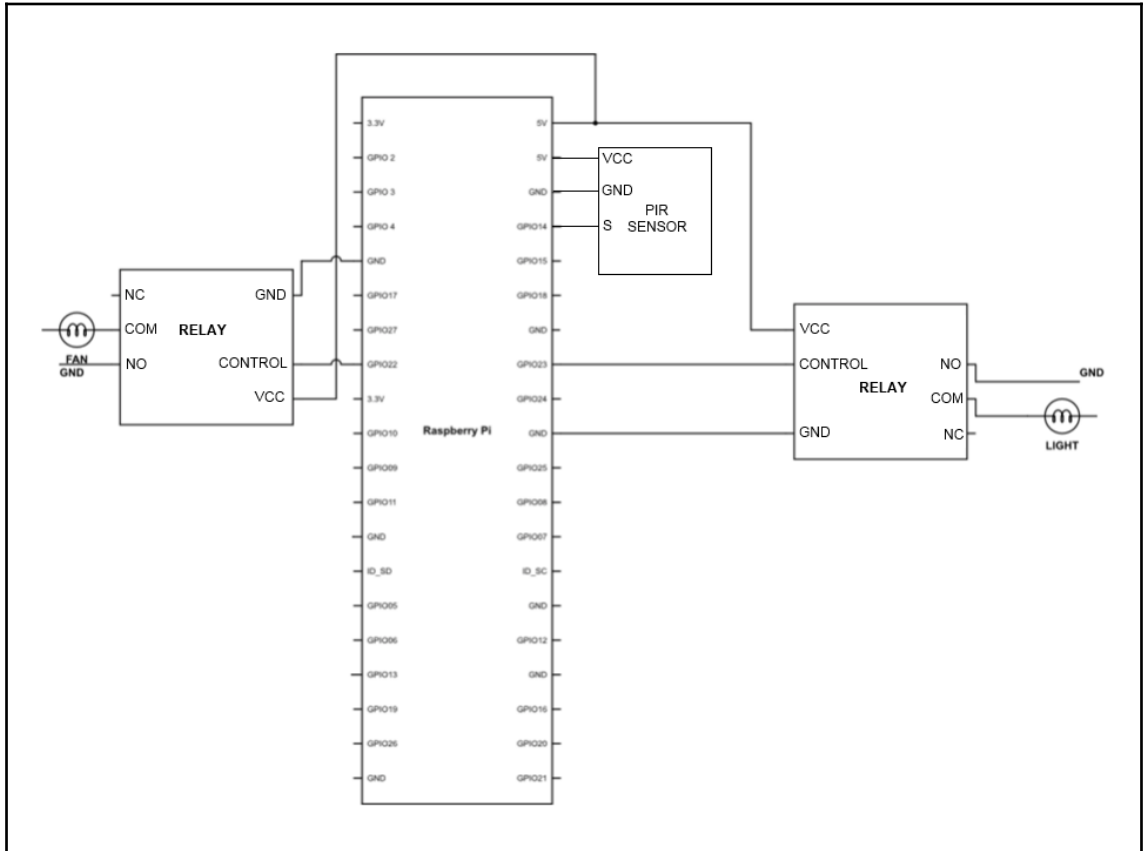
Save





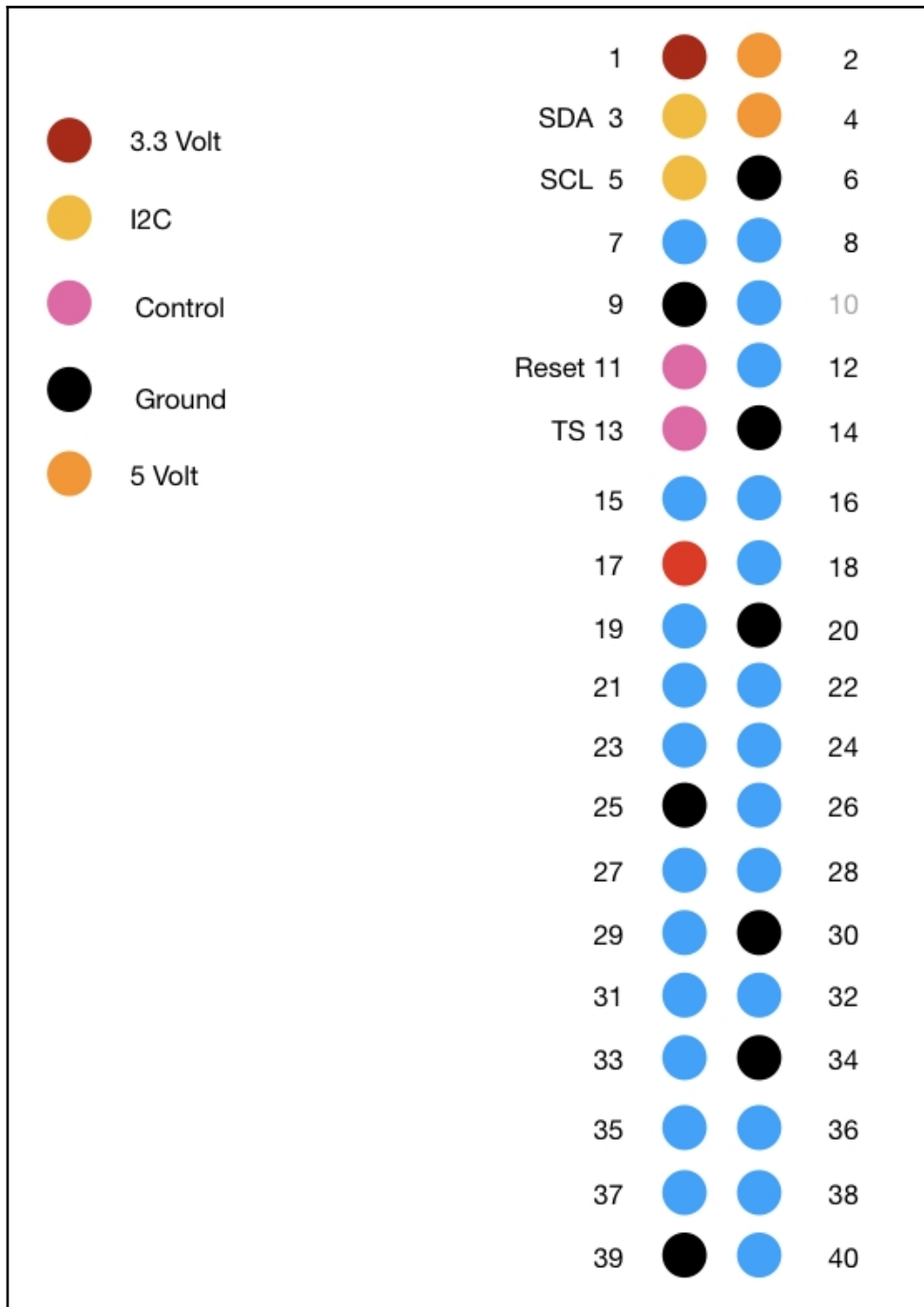


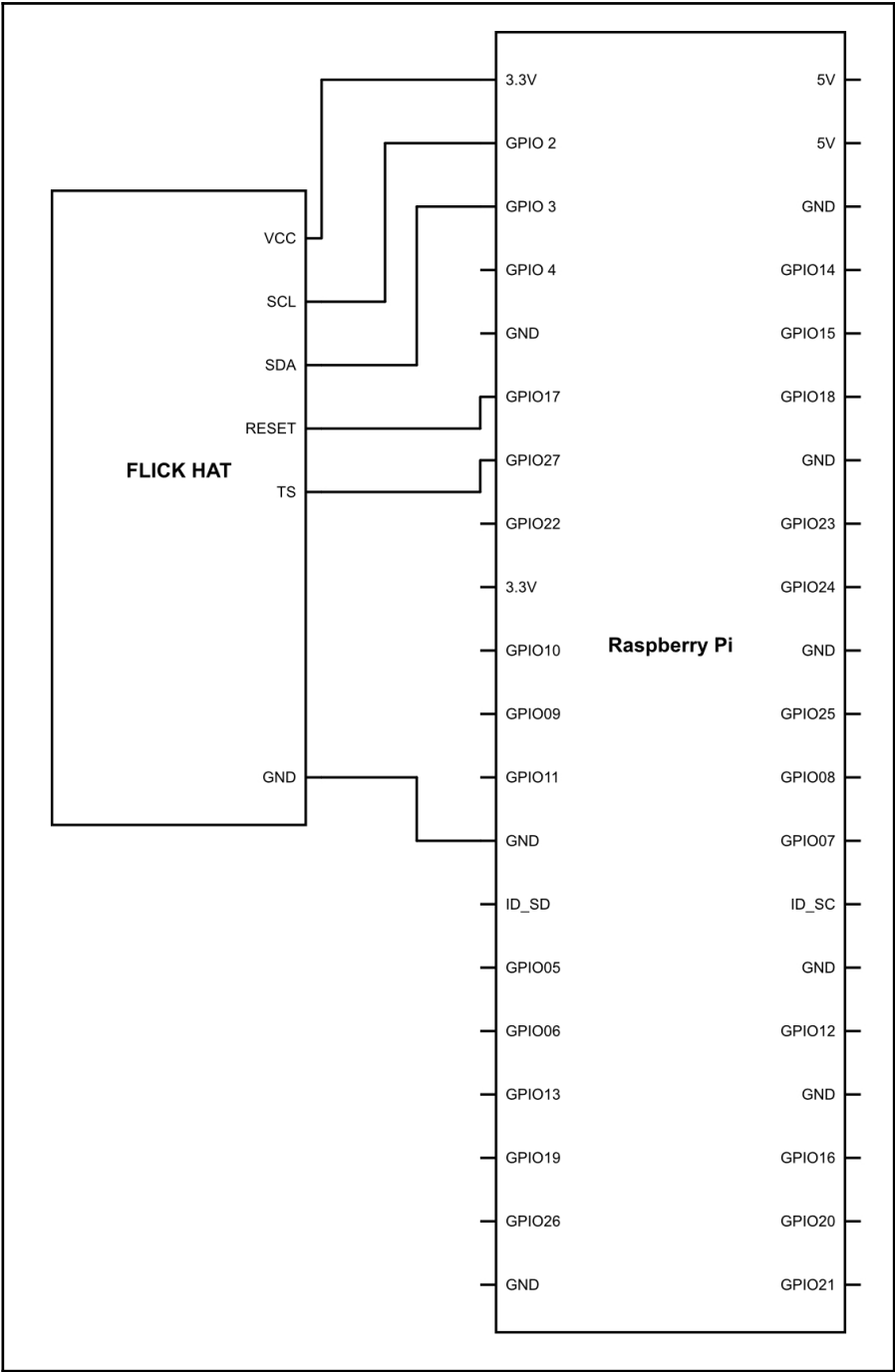
Chapter 14: Giving Voice to Jarvis

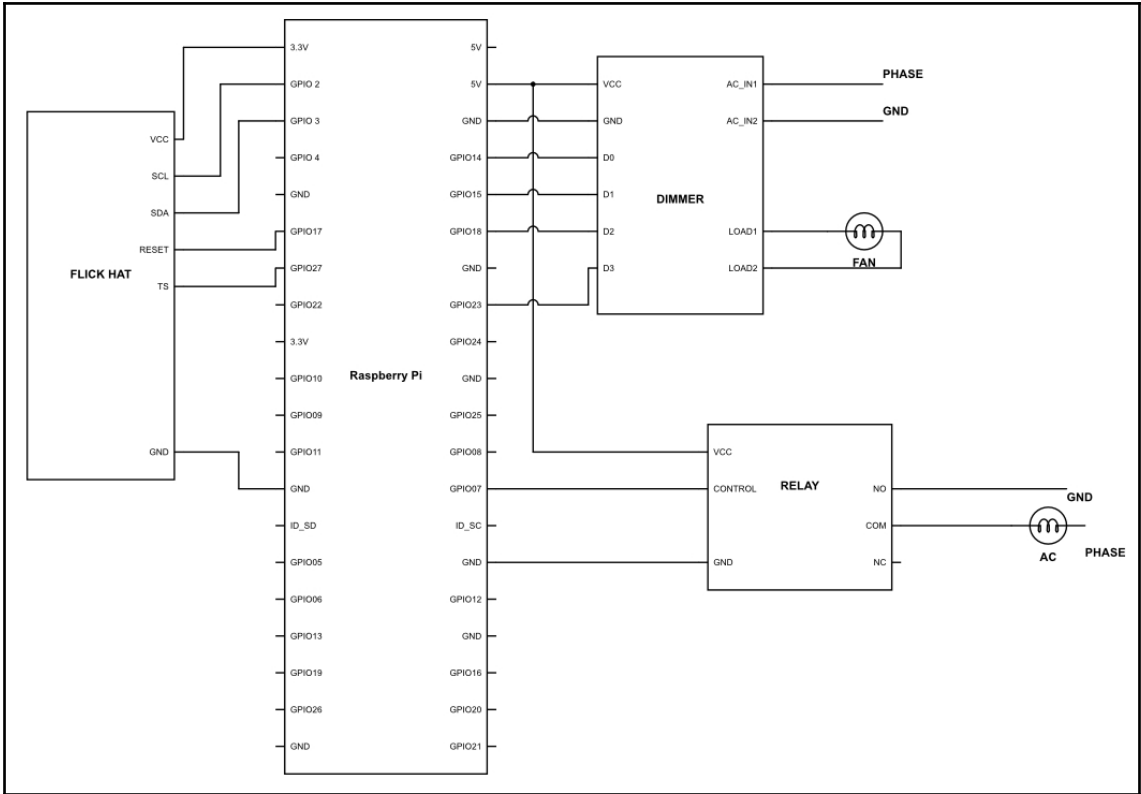


Chapter 15: Gesture Recognition

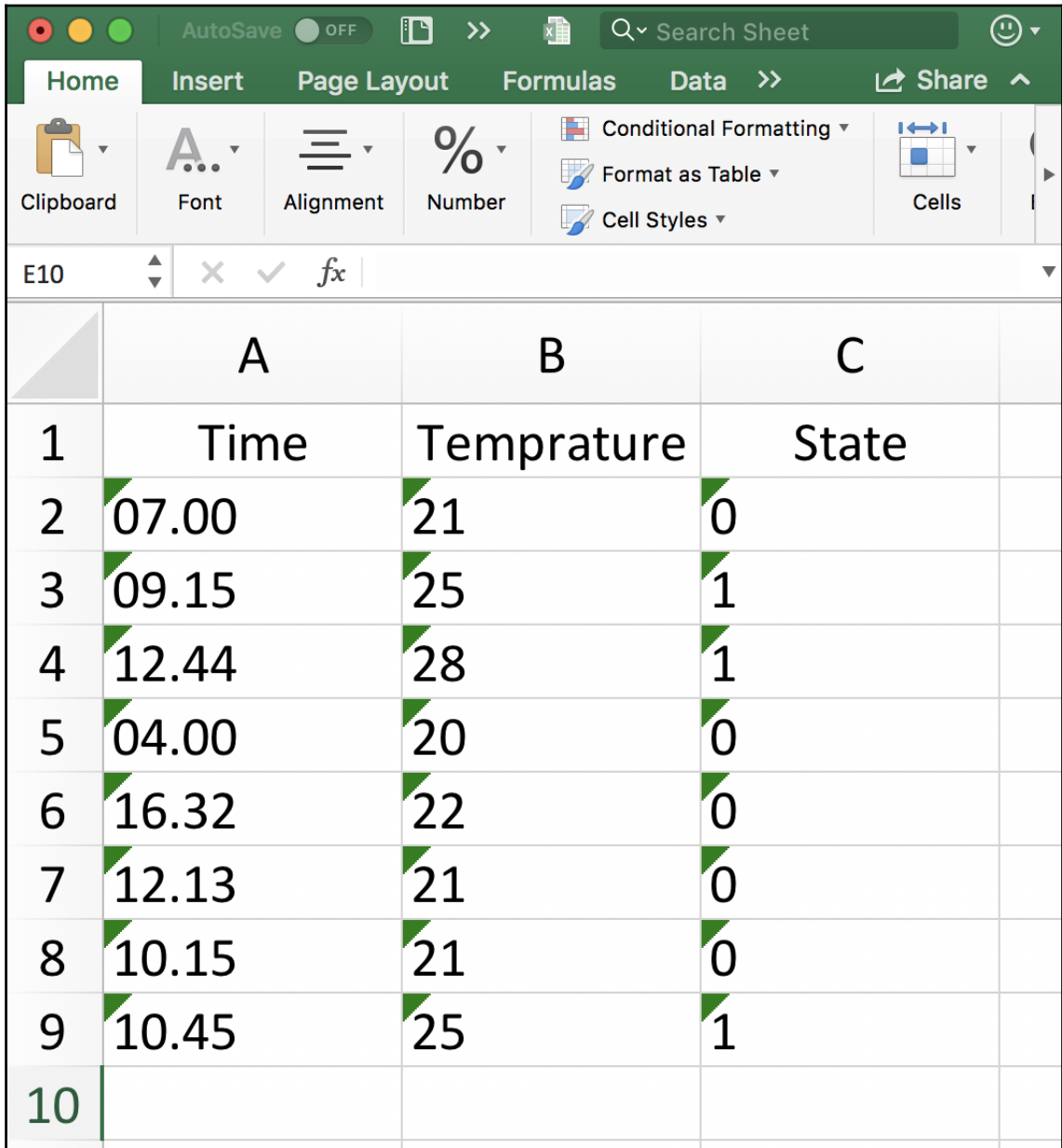






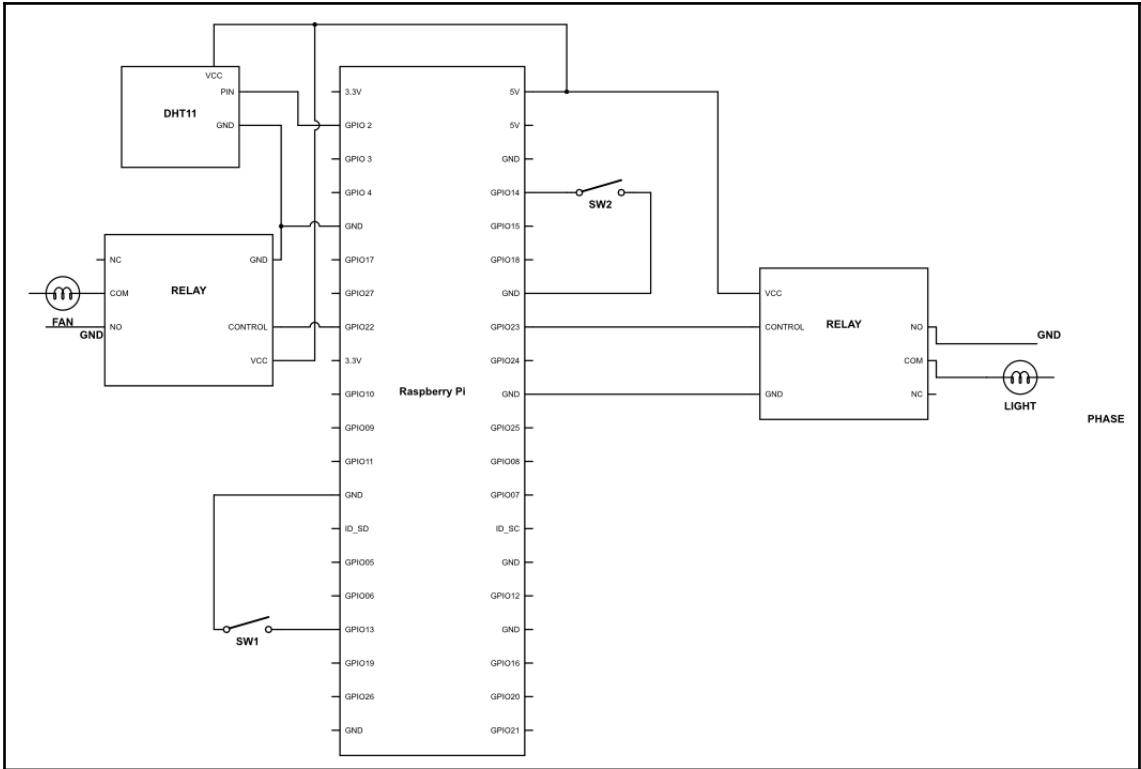


Chapter 16: Machine Learning

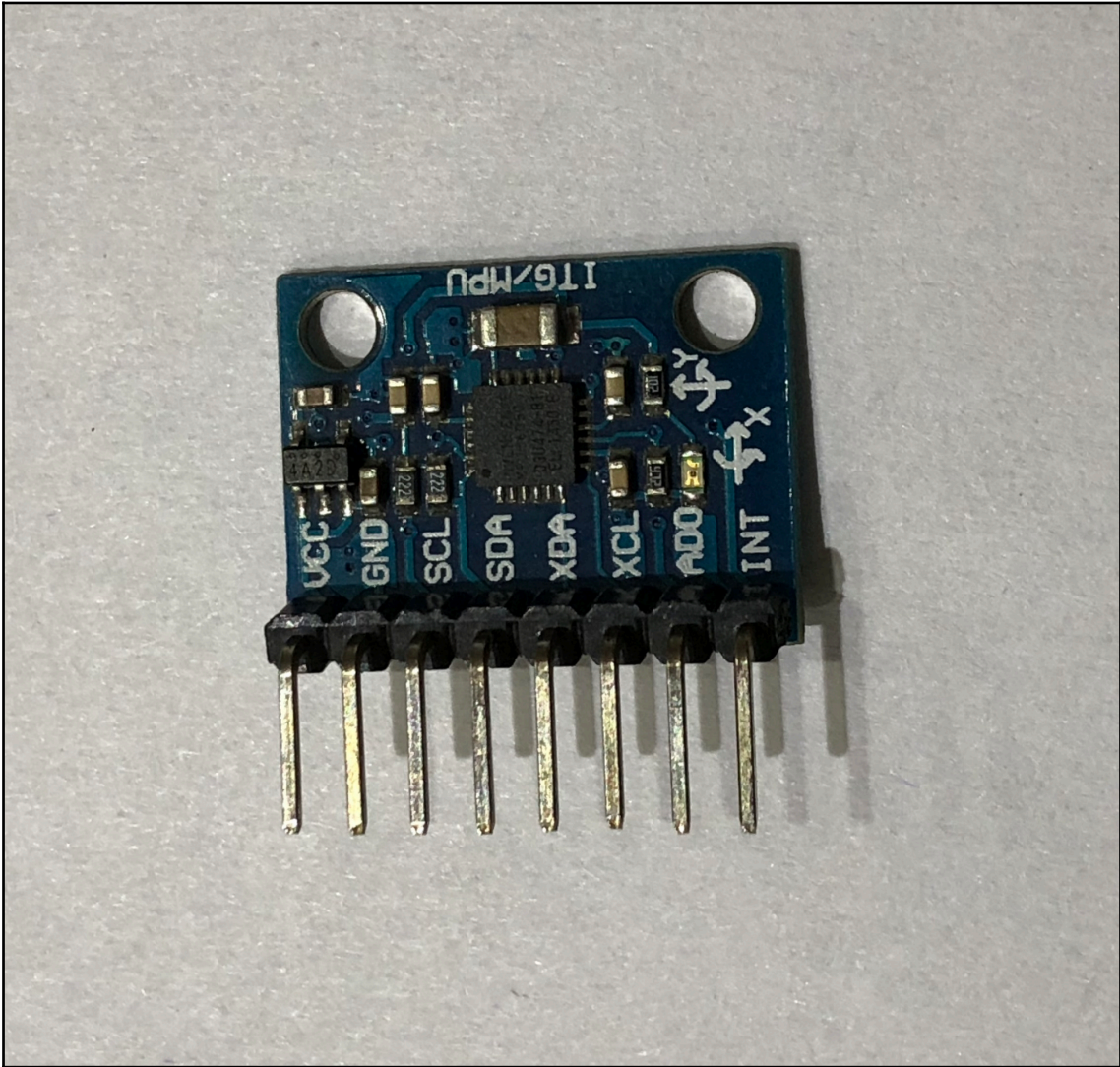


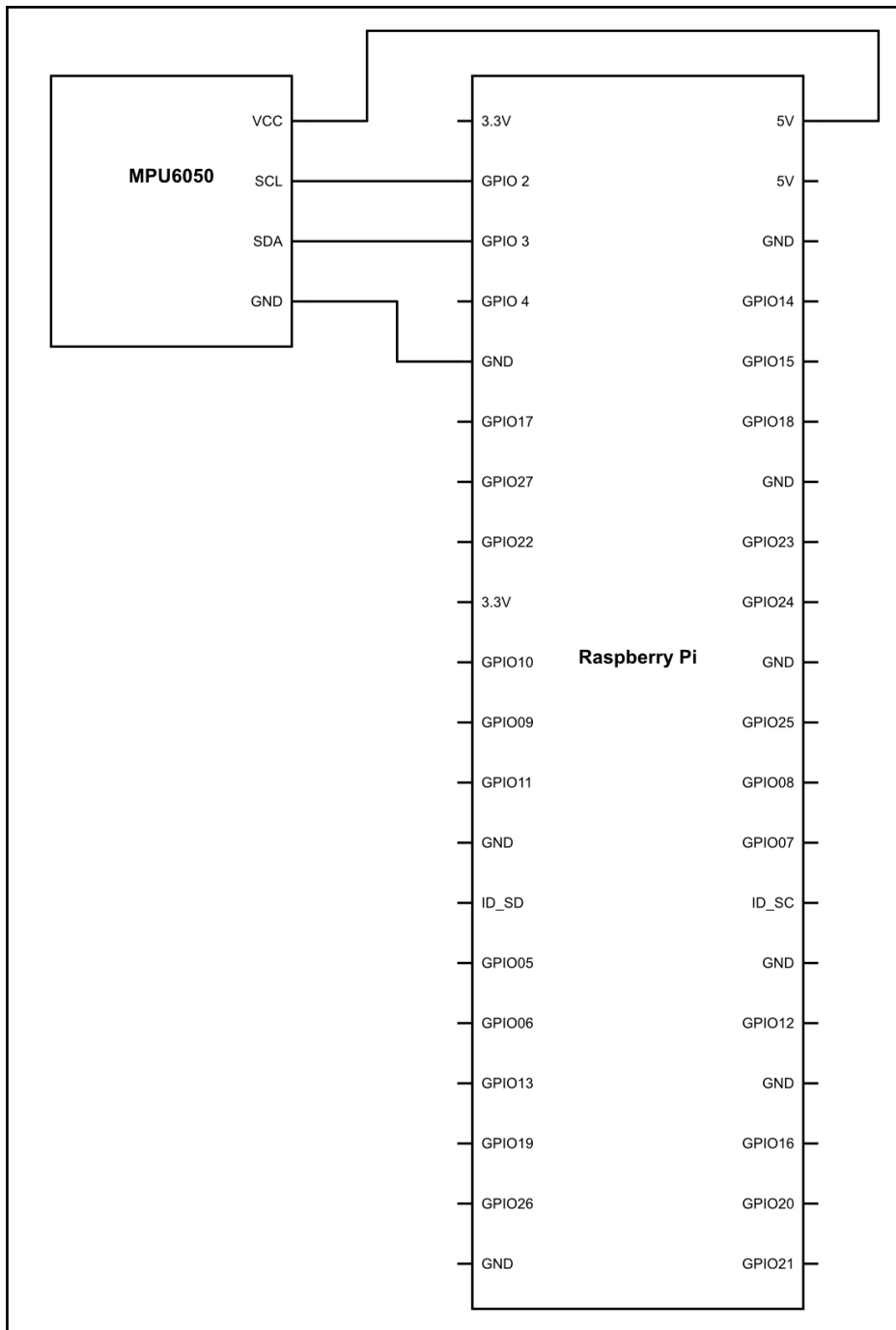
The image shows a screenshot of the Microsoft Excel application interface. The ribbon is set to 'Home', and the 'Cells' group is active. The active cell is E10. The spreadsheet contains a table with three columns: 'Time', 'Temperature', and 'State'. The data is as follows:

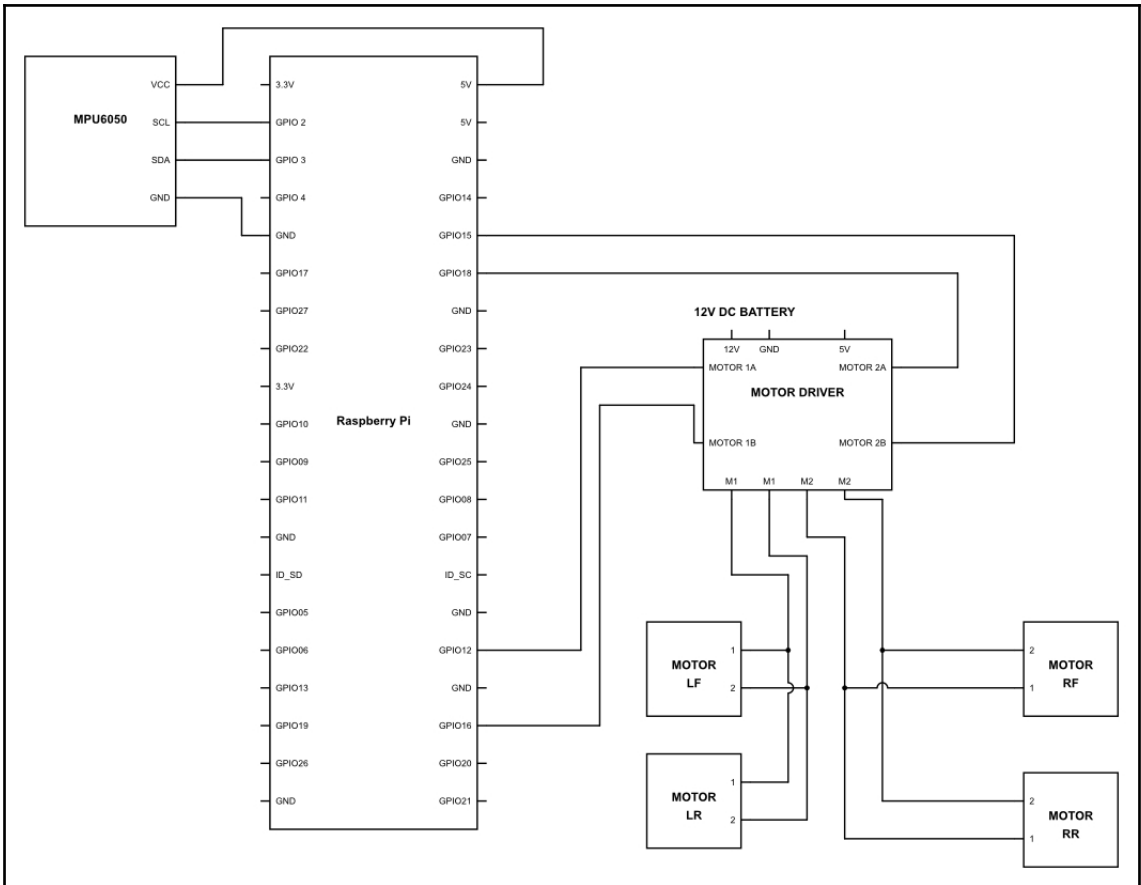
	A	B	C
1	Time	Temperature	State
2	07.00	21	0
3	09.15	25	1
4	12.44	28	1
5	04.00	20	0
6	16.32	22	0
7	12.13	21	0
8	10.15	21	0
9	10.45	25	1
10			



Chapter 17: Gesture-Controlled Robotic Vehicle







Chapter 18: Making a Robotic Arm

