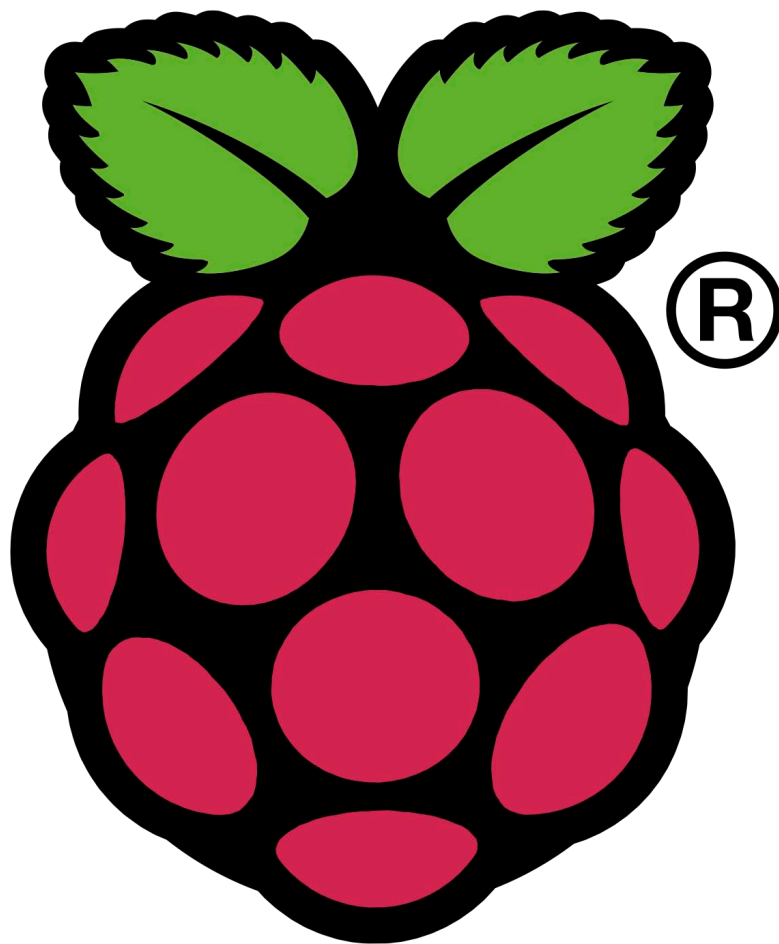


GETTING STARTED WITH RASPBERRY PI



Workshop Handout

Created by Furtherfield

Commissioned by Southend Education Trust

INTRODUCTION

AIM Introduce Raspberry Pi and answer some of the most basic questions.

WHAT IS RASPBERRY PI?

A card-sized computer
Introduction to its ports and components

WHAT'S GOOD ABOUT RASPBERRY PI?

It's portable, affordable, and it is less GUI oriented.

WHY CAN'T WE USE THE SCHOOL'S PCs?

You can! It just runs a different operating system: Linux based.

WHY DO WE WANT LINUX? Isn't it more complicated?

Linux makes it easier to understand how a computer actually works.

WHERE TO GET IT?

Rs Components, Farnell, Maplins.

WHAT TO BUY?

Check out our list of accessories: tinyurl.com/cfytxku

HOW TO INSTALL THE OS ON AN SD CARD?

Download the OS from: raspberrypi.org/downloads
Burn on an SD card following these instructions: elinux.org/RPi_Easy_SD_Card_Setup

GETTING STARTED

Assemble all the peripherals you'll need and power up your RP.

Update the system. On start up type the following command:

```
$ sudo apt-get update
```

RESOURCES

Raspberry pi Education Manual - <http://tinyurl.com/anvhs6o>

Techno Teacher - <http://about.me/alanodonohoe>

Raspberry Pi Youtube Tutorials Channel - <http://www.youtube.com/user/RaspberryPiTutorials>

Instructables, cool things with RP - <http://www.instructables.com/id/Raspberry-Pi-Challenge/>

Getting started with the Raspberry PI - <http://tinyurl.com/bbm4um7>

Quick start guide - <http://tinyurl.com/carjbos>

What to buy - <http://tinyurl.com/cfytxku>

WHAT'S A COMPUTER PROGRAMME?

AIM To gain a better idea of what a computer programme is by writing one that will be executed by a person. You will need to write a set of step by step instructions for one person to navigate to a particular location.

GAME INSTRUCTIONS

- Split into two groups.
- Write the instructions on a piece of paper using only the allowed words.
- The instructions will be executed by a member of the other team with a bag on the head.
- The goal is to reach the target.
- Instructions cannot be amended on the go.

ALLOWED WORDS

STEP - take one step forward

LEFT - turn to your left

RIGHT - turn to your right

REPEAT STEP (1-9) - take a number of steps as indicated in brackets

QUIT - take bag off your head

ESPEAK

AIM Learn how to download, install and then run a program just using the command line.

Test audio is working:

```
$ speaker-test -t sine -f 2600 > /dev/null
```

(You should hear a sound frequency being played through an attached speaker/headphone).

Quit the 'speaker-test' application by clicking 'ctrl+c'.

Make sure the Raspberry Pi is plugged into a working Ethernet connection.

Install the espeak application:

```
$ apt-get install espeak
```

Now make the computer speak:

```
$ espeak "Hello World"
```

ADVANCED: NETWORKED ESPEAK

AIM Learn how to log in to someone else's computer and remotely run espeak.

Figure out your IP address with the 'ifconfig' application:

```
$ ifconfig
```

Write your IP on a bit of paper.

Connect and login to someone else's computer via ssh (Secure SHell), replacing ?? with the actual number:

```
$ ssh pi@192.168.1.??
```

Now make someone else's computer speak:

```
$ espeak "Well hello there!"
```

WRITE SOME CODE IN THE PYTHON SHELL

AIM To get a sense of what the Python programming language looks like and learn how to do simple operations via the Python shell.

Enter the python shell by typing:

```
$ python
```

Now write the following and press return:

```
>>> print "hello world"
```

(You should see the string "hello world" printed below)

Now write the following and press return:

```
>>> w=10
```

Then this:

```
>>> print w*10
```

(You should see "100" printed below)

Now exit from the python shell by clicking 'Ctrl+d'

RESOURCES

Hello World! (<http://tinyurl.com/cbtdmt9>)

Raspberry pi Education Manual (<http://tinyurl.com/anvhs6o>)

ADVANCED: CREATE, SAVE AND RUN A PROGRAM VIA THE TERMINAL

AIM Write a programme that includes variables, strings and loops on a text file and run it from the terminal.

First list the content of the current directory:

```
$ ls
```

Then 'move' to the 'Desktop' directory:

```
$ cd Desktop
```

Create and open a new file to edit using the nano text editor:

```
$ nano testpython.py
```

In nano write the following and be sure to be very exact with the indentation. You don't have to copy the text preceded by a '#' as these are comments and are not required to run the code:

```
print "Start Loop"
w=20
for i in range(w):
    # Repeat the following command 'w' number of times
    start = ">"      # The start
    spaces = " *(w-i) # Generate the spaces
    dots = ". "*i*2  # Generate the dots
    end = "<"
    linenumber = " "+str(i)
    print(start+spaces+dots+spaces+end+linenumber)
print "End loop\n"
```

Then save and exit nano by clicking 'Ctrl+o', 'return', then 'Ctrl+x'.

Now run the program from the terminal:

```
$ python testpython.py
```

(You should see a pattern printed below)

INTRO TO THE DESKTOP

AIM Learn how to launch the desktop in Raspberry Pi (realising it's an application) and familiarise with the environment (browser, text editor, terminal etc.)

Launch Desktop:

```
$ startx
```

Find the browser, terminal, text editor, scratch, Python Integrated Development Environment (IDLE)

PYTHON PROGRAMMING ON THE DESKTOP

AIM There is an application called IDLE (Integrated Development Environment) on the desktop which provides a slightly easier means to edit and test your python code.

Double click on the IDLE icon on the desktop to start up the application.

(this takes you into the python shell where you can test commands)

Create a new window to write your program under 'File->New Window'

(this is where you write your python program)

Type:

```
Print "hello world"
```

Save the file to the desktop under 'File->Save'.

Run the code under 'Run->Run Module' (You should see its output in the python shell)

You can see and run other people's source code by opening .py files in the 'python_games' folder. Or there are millions of examples on the internet!

RESOURCES

Hello World! (<http://tinyurl.com/cbtdmt9>)

Raspberry pi Education Manual (<http://tinyurl.com/anvhs6o>)

A great website that introduces the 'pygame' library: www.pygame.org/wiki/tutorials.

This cheat sheet is very helpful: <http://inventwithpython.com/pygamecheatsheet.png>

INTERMEDIATE: GRAPHICS PROGRAMMING IN PYTHON

AIM Learn how to draw circles using python.

With IDLE create a new file called "graphics.py"

Write the following code:

```
# Set stuff up
import pygame, sys
from pygame.locals import *
print "start game"
pygame.init()
blue = (26,0,255)
cream = (254,255,250)
position = (250,250)
linewidth = 2
size = (500,500)
radius = 50
window = pygame.display.set_mode(size)

# Draw stuff
while 1:
    window.fill(blue)
    pygame.draw.circle(window, cream, position, radius, linewidth)

# Register user actions (allow the user to close the programme)
for event in pygame.event.get():
    if event.type == QUIT:
        pygame.quit()
        sys.exit()

# Keep displaying my drawing
pygame.display.update()
```


ADVANCED: GRAPHICS AND INTERACTIVITY IN PYTHON

AIM Learn how to draw circles using python.

With IDLE create a new file called "graphics-mouse.py"

Write the following code:

```
# Set stuff up
import pygame, sys
from pygame.locals import *
print "start game"
pygame.init()
blue = (26,0,255)
cream = (254,255,250)
mousex, mousey = 0,0
size = (500,500)
radius = 50
linewidth = 2
window = pygame.display.set_mode(size)

# Draw stuff
while 1:
    window.fill(blue)
    position = (mousex,mousey)
    pygame.draw.circle(window, cream, position, radius, linewidth)

# Register User Actions (quit, mouse movements)
for event in pygame.event.get():
    if event.type == QUIT:
        pygame.quit()
        sys.exit()
    elif event.type == MOUSEMOTION:
        mousex, mousey = event.pos

# Update my drawing
pygame.display.update()
```

INTRO TO SCRATCH

AIM Get your head around the logic of programming & animation with this graphical programming application. With scratch you write a set of instructions for a character to execute.

1 HELLO WORLD

- Click on a character (aka a sprite) from the sprites list (bottom right) to select it.
- Click on **Blocks Palette**, click on the **Looks** button.
- Drag the block labelled “say [Hello] for [2] seconds” to the **Scripts** tab
- Replace “Hello” with “Hello World”. Double-click the block.

* Whether we are writing in Python or creating a script with Scratch using different blocks, the logic is the same: we are writing instructions that the computer can understand and execute.

2 MAKE YOUR CHARACTER MOVE

- Click on a character (aka a sprite) from the sprites list (bottom right) to select it.
- Click on **Blocks Palette**, click on the **Motion** button.
- Drag the block labelled “turn [15] degrees” to the **Scripts** tab. Then write 90 degrees instead of 15.
- Click on **Blocks Palette**, click on the **Looks** button.
- Drag the block labelled “say [Hello] for [2] seconds” to the **Scripts** tab and snap it to the previous one.
- Write “I can turn.”
- Click on **Blocks Palette**, click on the **Control** button.
- Drag the block labelled “Repeat [10]” and place it around all the previous two blocks.
- Drag the block labelled “When [Green Flag Icon] Clicked” to the top of these blocks.
- Now add one more block, at the bottom of your script, outside the repeat structure: From the **Looks** palette, drag the block labelled “say [Hello] for [2] seconds” to the **Scripts** tab, edit the text to say “I no longer want to move.”
- Click on the green flag to execute the script you’ve created.
- Experiment with different options!

RESOURCES

Raspberry pi Education Manual (<http://tinyurl.com/anvhs6o>)

Scratch Site (<http://scratch.mit.edu/>)

Video Tutorials (<http://scratch.mit.edu/>)

SWITCH AN EXTERNAL LED ON AND OFF

AIM Raspberry Pi can be used to read sensors (to measure light, temperature, pressure, distance, etc) and to drive actuators (for instance, switch ON and OFF LED lights and small motors)

Open a terminal window.

Then 'move' to the 'Desktop' directory:

```
$ cd ~/Desktop
```

Create and open a new file to edit using the nano text editor:

```
$ nano gpio.py
```

In nano write:

```
import RPi.GPIO as GPIO
pin = 4
GPIO.setmode(GPIO.BCM)
GPIO.setup(pin, GPIO.OUT)
state = False
while 1:
    GPIO.output(pin, state)
    command = raw_input("wait for key")
    state = not state
```

Then save and exit nano by clicking 'Ctrl+o', 'return', then 'Ctrl+x'.

Run the program (as the root user) from the terminal:

```
$ sudo python gpio.py
```

Attach an LED with to pins 4 and 6.

Press return.

RESOURCES

<http://www.raspberrypi-spy.co.uk/2012/06/simple-guide-to-the-rpi-gpio-header-and-pins>

RESOURCES

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GPIO pins - <http://www.raspberrypi-spy.co.uk/2012/06/simple-guide-to-the-rpi-gpio-header-and-pins>

What to buy - <http://tinyurl.com/cfytxku>

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Commissioned by Southend Education Trust

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Inspired by "The Raspberry Pi Education Manual" and the Raspberry Pi Education Wiki



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