**Hello World Lesson Plan Template**

**Please replace all blue text before submitting your lesson plan to sian@helloworld.cc.**

**@Title -** 2-6 words

Crash landing – Forecasting the weather!

**@Author**

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**@Biography**

Physics and KS3 Computer Science teacher from the West Midlands. Certified Raspberry Pi Educator with a passion for developing cross-curricular approaches to Computer Science in schools with no Computer Science teachers. @makercupboard

**@Headshot**

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**@Standfirst -** 10-25 words

Survive a crash landing in the jungle using a Raspberry Pi and Python – introducing the SenseHat and making environmental measurements

**@Equipment requirements - 2 to 5 bullet points**

• Raspberry Pi 3

• SenseHat or SenseHat emulator

**@Health and safety requirements**

In this activity you will be making real time temperature measurements. You might want to try using a hairdryer to gently warm up the Raspberry Pi. The Rasperrry Pi may get hot and be careful not to burn yourself.

**@Age range**

**11-13**

**@Year group/assessment level**

Key Stage 3

This activity will also support Key Stage 3 Scientific Enquiry particularly around collecting precise and accurate data.

**@Lesson type**

• Text-based programming

• Physical computing

• Project-Based learning in Science

An Enrichment activity

**@Learning Objectives**

To be able to take real-world measurements using the SenseHat

To be able to present data in a useful way

To be able to analyse data to make predictions

**@Introduction -** 200 words

These activities can be used in both computer science lessons or in a cross-curricular science project. The activities will give students opportunities to take real world measurements with the SenseHat.

Activity 1 introduces students to taking measurements from the SenseHat and formatting the results to make them more readable. The activity also gives students an opportunity to use if … then … statements to respond to the measurements.

Activity 2 builds on the first task and takes measurements of atmospheric pressure and displays them in a useful format as a bar chart on the SenseHat LED matrix.

This lesson was used as a cross-curricular science and Computer Science unit and introduced students to collecting real world data using digital means and then presenting it in a useful way.

During this lesson we will learn how to take some environmental measurements and then use them to respond to the readings. This will include:

* Measuring the temperature of the surroundings
* Measuring the air pressure and detect if it is changing
* Predicting if there is a storm coming

The **main content of the lesson plan** follows below. Feel free to repeat or delete sections as relevant (e.g. some lessons may have two main activities)

**@Activity 1/Starter activity - name and timing**

Crash landing! – setting the scene 5 mins

**@Activity 1/Starter - description**

Set the scene with the story below.

You were travelling on holiday with your trusty bag of technology including a Raspberry Pi, SenseHat and micro:bits. Half way there you crash land in the jungle. You will need to use your wits, cunning and programming skills to survive your time in the jungle.

Students can use post-it notes or paper to make a list in groups of all the things they would need to survive in the jungle.

Pose the question: How could we use technology to keep us safe?

**@Activity 1 image (optional)**

**@Activity 2/Main activity - name and timing**

Introducing the SenseHat – 10-15 mins

**@Activity 2/Main activity - description**

Talk through with students the history behind the SenseHat and the AstroPi story. Use these videos from YouTube to illustrate this.

Use a handout of the SenseHat to identify different ways in which the SenseHat could be used to help us in the jungle.

If you don’t have access to a SenseHAT your can use the SenseHAT emulator on the Raspberry Pi. You can also use the trinket SenseHAT emulator here <https://trinket.io/sense-hat>

If you are using the physical SenseHAT on a Raspberry Pi or trinket start the code with

```python

from sense\_hat import SenseHat

```

If you are using the SenseHAT emulator you will need to start the code with

```python

from sense\_emu import SenseHat

```

Measuring the temperature of the classroom:

We want to find out the temperature of the jungle so we can fetch the current temperature value and print it out.

```python

sense=SenseHat()

temp = sense.temp

print(temp)

```

What do you notice about the temperature?

We need to change the temperature and make it more readable by removing the extra digits after the decimal point.

```python

temp = round (temp,2))

print (temp)

```

Now we have an accurate measurement of the temperature in the jungle we need to know if it going to be safe for us to survive.

If your body temperature gets higher than 38.3 oC you will enter hyperthermia and if it drops below 10 oC you run the risk of hypothermia.

```python

if temp < 10:

print ("Warning too cold - risk of hypothermia")

elif temp >38:

print ("Warning too hot - risk of hyperthermia")

else:

print ("Safe temperature")

```

**@Activity 2 image (optional)**

**@Activity 3/Plenary activity - name and timing**

Making a barometer – is it going to rain?

Use this code to make your own barometer (25 mins)

E.g. ‘Quick mini-whiteboard quiz - 5 minutes’

**@Activity 3/Plenary activity - description**

Weather forecasters use air pressure as a way of predicting the weather. You might have seen a barometer before or even have one at home. In this task we are going to use the Raspberry Pi to log the air pressure and predict if a storm is coming.

Start a new Python3 file and this time we will be collecting the air pressure

```python

from sense\_emu import SenseHat

sense = SenseHat()

while True:

pressure = sense.pressure

print (pressure)

```

Run the code and watch the long list of air pressures disappear in front of you – this is not going to be the simplest way to observe a change in air pressure.

The SenseHAT can measure a pressure range from around 250 mbar to 1250 mbar. We can use the pixels on the SenseHAT to show the pressure as a bar chart.

```phython

from sense\_hat import SenseHat

from time import sleep

sense = SenseHat()

r=[255,0,0]

sense.clear()

while True:

for c in range (0,7):

pressure = sense.pressure

print (pressure)

graph\_pressure = int(pressure / 150)

print (graph\_pressure)

for i in range(graph\_pressure):

sense.set\_pixel(c,i,r)

print (c)

sleep(300)

sense.clear()

```

The actual value of the pressure is divided by 150 to give a value between 0 and 8 which can be displayed on the SenseHAT pixels as a bar. Every 10 minutes a new value is taken and the next bar is displayed. After all 8 bars are displayed the loop restarts.

Over the hour you can monitor the weather by looking at the air pressure.

If the air pressure is high we can predict clear skies, light winds and bright weather.

If the air pressure is low we can predict we are in for cloudy and wet weather.

If the air pressure starts to drop we can predict a change in the weather and we might need to get out our rain coat or umbrella.

**@Activity 3 image (optional)**

**@Activity 4/Plenary activity - description**

In the next lesson we will use some of the other sensors on the SenseHat to help with our survival. Students can think about possible other uses and brain storm a list of possible solutions.

**@Assessment**

This may be the first time that the students have used the SenseHAT and an assessment opportunity could be based around using sensors and measurements in real life. When is it useful to remotely collect data? When could this be used in a Science lesson for example.

**@Differentiation**

Possible extension:

* How would you change the colour of the bars to show a drop in air pressure?
* Could you trigger an alert if the pressure drops dramatically in a short space of time

**@Relevant links**

**I have attached a worksheet which I used with the students. The images are ones found on Google images.**

**@Illustration**

IMG\_20190329\_153055.jpg

IMG\_20190329\_153105.jpg

IMG\_20190329\_153606.jpg

IMG\_20190329\_153621.jpg

IMG\_20190329\_154112.jpg

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**@Illustration caption - 10-25 words**

Students completing the activity

X

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If any **images of children** are included in your submission please tick this box to confirm that you have obtained agreement from their parents to the use of these images in the magazine. Do not delete this box if relevant.

**Image requirements**

At Hello World we really value photographs and illustrations from our contributors and would always prefer to use these over stock images. We are a print and digital publication, which means we need the highest quality images as possible.

* Please ensure you are sending over the **original, non-compressed** image (some email providers will, by default, reduce image size) in **jpeg format where possible**
* As a rule of thumb, images need to be **several MB in size (headshots at least 1MB)**
* When taking **screenshots**, make sure the resolution of your screen is set to its maximum and make the window you are taking a snapshot of as large as possible. If the screenshot includes code please maximise the font size.
* For screenshots from Raspberry Pi you can use raspi2png: <https://github.com/AndrewFromMelbourne/raspi2png>