Contents

1 Introduction to Python

Python is a high-level programing language with a lot of powerful capabilities. It is simple to learn and fast to develop in, and is ideally suited for many tasks. Here in S3 we use it for both commercial deployment, as well as internal tasks such as document generation, test script execution and personal projects.

There are plenty of tutorials on the internet for reference, e.g.
http://sthurlow.com/python/

Python looks very like English and therefore is very simple to write.

2 Interacting with real world items

Many computer programs do not really "do" much - they run on a PC and never really interact with the real world. We are going to develop a simple motion-detecting device which will.

- Wait for some movement
- Take a photograph
- Email it to an email address (this bit is a bit limited here in S3, it can't send an email outside the company)

We are going to do so using the Raspberry Pi, a cheap, very powerful micro computer which has been designed especially to make computing accessible to students and people wishing to learn about coding and software.

In order to detect the motion, we will use a P.I.R - a Passive Infrared Receiver. These are in use in all sorts of things like burgler alarm sensors, security lights, even the glade room-scent plug-ins which release an aroma as you walk past. They are very cheap, only a few euro on Ebay or similar.

To take the picture we will use the Raspberry Pi Camera add-on to take the photo.

Using the power of Python, we shall be able to send am email to one or more addresses, with the photo attached. So you could set this up in your room and know if someone has been into it while you are away.

Of course there are other things that a setup like this could do - we could change the behaviour of this so that instead of taking a picture and emailing it, it could be used to turn on a light when you enter a room instead. The possibilities are endless.

Lets go....

3 Detecting Movement

The first stage is to get the raspberry pi to detect movement. A PIR sensor is connected to the board with 3 wires.

- +5v
- 0V
- Data

+5v and 0 power the PIR sensor, and the Data connection is used to tell the Raspberry Pi when the sensor has detected movement

Reference : http://www.raspberrypi-spy.co.uk/2013/01/cheap-pir-sensors-and-the-raspberry-pi-part-1/

The code from this example is on the Raspberry Pi already, in the file "pir_sensor.py"

This code does some small amount of setup, and then enters a loop which continuously reads the value of the data pin from the sensor.
If this value is "1", then the sensor is indicating that it has detected some movement.
If the values is "0", then the sensor has not detected any movement

We can run this code by typing
sudo python pir_sensor.py
So this script will sit there and print "Motion Detected!" when it notices movement and "Ready" when it has reset and is waiting for the next movement to occur

To exit the program, type the Ctrl Button and 'C'

3.1 Tasks:

1. Run this script, as indicated above, and ensure that when you move near the sensor it detects it, and does not do so when you are still.
2. Edit the file and change the messages which are printed out when motion is detected, and when it is ready to detect again.

4 Taking a photo

Now that we can detect motion, it's time to take a photo. In order to do this we use a python building block, called picamera, to take the photo.

Reference: https://www.raspberrypi.org/picamera-pure-python-interface-for-camera-module/

The code for this part is on the Raspberry Pi already, in the file "takephoto.py"

We can run this by typing
python takephoto.py
And it should create a picture called "image.jpg" which contains an image of the area the camera is pointing at.

It's a very simple piece of code, all it does is say
- use the picamera module
- take a picture and call it "image.jpg"
- say when you've done that

4.1 Tasks:

1. Run this script, as indicated above, and ensure that it takes a photo
2. Edit the file and change the name of the photo it creates from "image.jpg" to "motion.jpg"

5 Sending an Email

Python includes a lot of powerful functions to do all sorts of wonderful things very simply, and one of these is to send an email
Reference : https://docs.python.org/2/library/email-examples.html

There's a script on the raspberry pi which sends an email with an attachment
We can run this with
python emailer.py
but this will fail as we have to tell it who to send the email to

So edit this file and change the line that says
to=None#"your.name@s3group.com"
and make it
to="yourEmailAddress@s3group.com"
e.g.
to="ann.smith@mail.ie"

and save this. Now when we run it
python emailer.py
it will try to send the photo to your email address. But we changed the name of the photo from "image.jpg" to "motion.jpg", so we need to change the emailer script again so that it uses "motion.jpg".

5.1 Tasks:

1. Run the script and verify that it sends an email with the photo
2. Change the script so that the subject line reads "INTRUSION ALERT" and that the email body says "Motion has been detected near the observation zone", instead of "See for yourself"
3. Take a few different photos using the "takephoto.py" script and email them using the "emailer.py" script

6 Tying it all together

So now we have all the individual pieces of the puzzle which allow us to:

1. Detect Motion
2. Take a photo
3. Email the evidence

It's time to tie it all together into one program which does it all.

6.1 Task:

1. Create a new file called "motioncamera.py"
2. Using the code from the 3 other files, create a program which waits for motion to be detected, and when it does so, take a picture and email it to you

Some issues you may encounter :

Spaces are very important in python so you may get an error saying "unexpected indent" or similar

You might get an error like "picamera.exc.PiCameraMMALError: Camera component couldn't be enabled: Out of resources (other than memory)" when trying to take a photo. This means that you have already opened the camera (camera = picamera.PiCamera()) - there is only one camera so it only needs to be opened once.

You might see an error like this : "RuntimeError: No access to /dev/mem. Try running as root!" when trying to run the program. Use "sudo python motioncamera.py" instead

ANY QUESTIONS JUST ASK!

7 Other things to do

If we get all this done, there are other things we could do - for example

1. Take a short video rather than a photo, and email that
2. Change the mechanism so that rather than a PIR, this is connected to a button so that it could be used as a doorbell