

# Assignment 05: On Device Control

## PH1050 Computational Physics

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1<sup>st</sup> year EP

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### Problem Statement

We must monitor a region continuously and raise a beep/ voice alert when an intrusion (movement) is detected. We also have to plot the parameter being considered.

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### Aim

To monitor and display the region being monitored continuously and raise a beep/ voice alert when an intrusion (movement) is detected. We also have to plot the value of the parameter being considered (plot is of parameter vs time).

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### Introduction

In order to ensure the monitoring of the region, we must allow mathematica to access our computer's camera using the function `DeviceOpen["Camera"]`. The main idea for motion detection is to store the first image captured in a variable (`img1`) and see values of `Mean[Mean[Total[ImageData[img1,CurrentImage[]]]]]` for subsequent images captured. When the value of this exceeds 20 (this value was arrived at by trial and error), the alarm must go off as this is a clear indication that some motion has occurred. (As now the `CurrentImage[]` and the original image are significantly different.) Plotting of the graph was done by appending the values of {time , mean pixel value of `ImageDifference`} to a list and then plotting the list using `ListLinePlot[]` function.

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### Code Organization

Part1: Alarm going off

- 1)Capturing the original state and assigning it to a variable `img1`
- 2)using the function `Dynamic[]` to continuously display the image being captured at that moment.
- 3)Declaring a while loop in which we capture images at regular intervals of 0.5 seconds using the function `Pause[]`.

We define the while loop such that it exits when the value of `Mean[Mean[Total[ImageData[img1,CurrentImage[]]]]] > 20` (Indicating that motion has occurred)

- 4) Once it exits the While loop , the i have placed the alarm which is to go off and a voice which says "Intruder detected".

Part 2: Plotting

- 1) When the while loop runs, we simultaneously append the values of {time , mean pixel value of ImageDifference} to a list
- 2) Then using ListLinePlot[] we plot the graph.

## Code for computation

```
In[629]:=
$ImagingDevices



Out[629]=
{HP True Vision 5MP Camera}

In[813]:=
Clear["Global`*"]

In[814]:=
dev = DeviceOpen["Camera"]
list1 = {};
img1 = CurrentImage[];
Dynamic[CurrentImage[]]

t = 0;
While[Mean[Mean[Total[ImageData[ImageDifference[img1, CurrentImage[]]]]]] < 20,
  AppendTo[list1,
    {t, Mean[Mean[Total[ImageData[ImageDifference[img1, CurrentImage[]]]]]]};
  IntImage = CurrentImage[];
  Pause[0.5];
  t += 0.5]
DeviceClose[dev]
list1
s = SpeechSynthesize["Intruder Detected"]
EmitSound[s]
signal = Play[Sin[1500  $\times$  2 Pi t^2], {t, 0, 5}]
EmitSound[signal]
IntruderImage = IntImage
ListLinePlot[list1, Filling  $\rightarrow$  Axis,
  FrameLabel  $\rightarrow$  {{ "Mean Value of Pixel Difference"}, {"Time"}}, PlotLabel  $\rightarrow$  "Graph"]
```

Out[814]=

DeviceObject [  Class: Camera ID: 1  
Status:  Not connected (HP True Vision 5MP Camera) ]

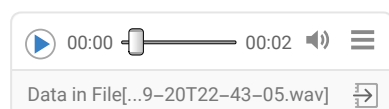
Out[817]=

\$Aborted

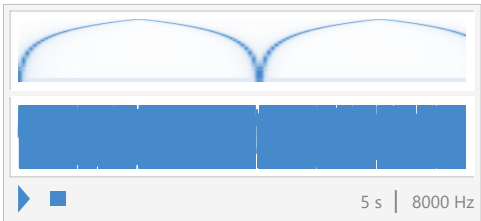
Out[821]=

{{0, 17.0539}, {0.5, 41.8069}}

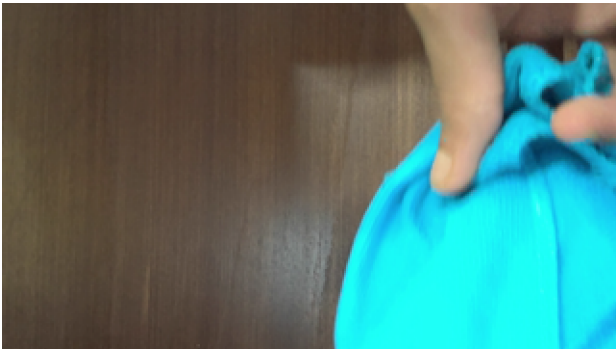
Out[822]=



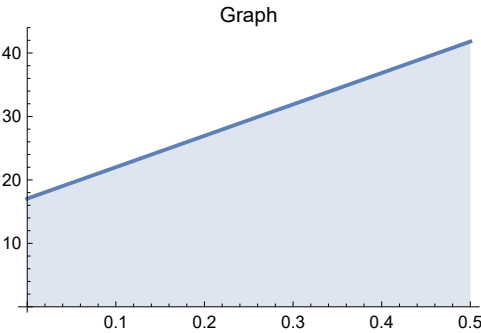
Out[824]=



Out[826]=



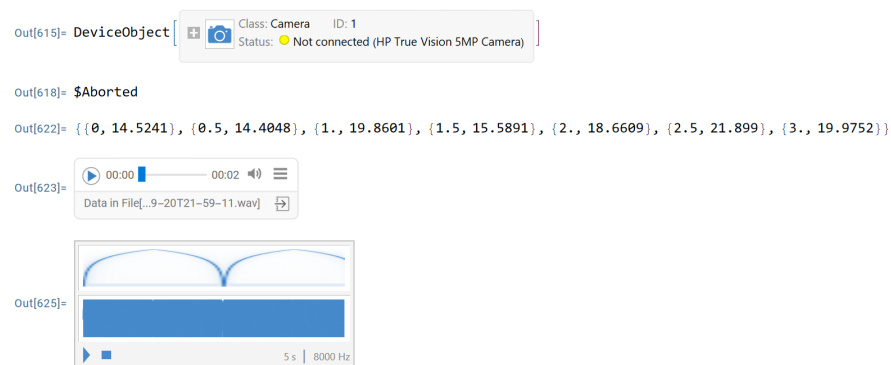
Out[827]=



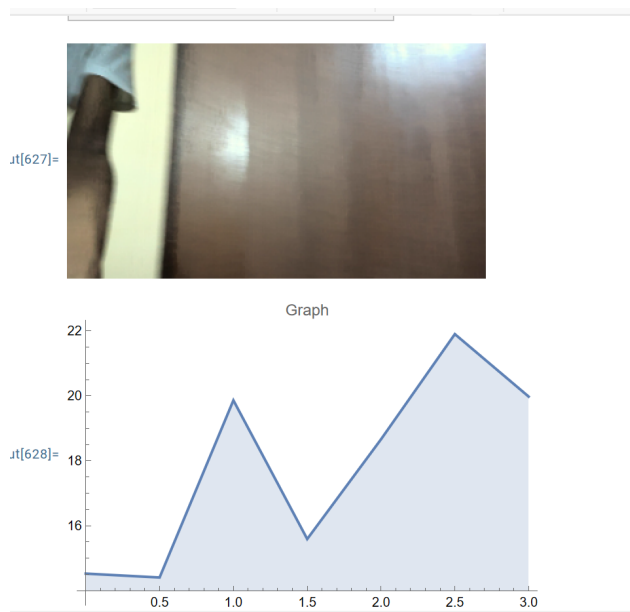




## Results



(\*The list with the values of {t,mean pixel value of ImageDifference}  
the alarms which go off\*)



(\*The image captured at the moment of intrusion  
andd the graph of {time,mean pixel value of ImageDifference}\*)

## Comments

This assignment was definitely more interesting and cooler than the others.

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## References

1. <https://chat.openai.com/>