| Topic | Security System using webcam | |
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| Class Description | **Students take up a project to create a security system for their pc, where the system will snap a photograph of the person using their system every few minutes and uploads these pictures in cloud storage.** | |
| Class | **C102** | |
| Class time | **45 mins** | |
| Goal | • Capture image from webcam using opencv python module<br>• Create a python program which captures webcam image every few minutes and uploads on the dropbox | |
| Resources Required | • Teacher Resources<br>  ○ Visual Studio Code<br>  ○ Laptop with internet connectivity<br>  ○ Earphones with mic<br>  ○ Notebook and pen<br>• Student Resources<br>  ○ Visual Studio Code<br>  ○ Laptop with internet connectivity<br>  ○ Earphones with mic<br>  ○ Notebook and pen | |
| Class structure | **Warm Up**<br>**Teacher-led Activity**<br>**Student-led Activity**<br>**Wrap up** | **5 mins**<br>**15 min**<br>**15 min**<br>**10 min** |

**CONTEXT**

- **Introduce the pc security project**

| Class Steps | Teacher Action | Student Action |
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| **Step 1:**<br>**Warm Up**<br>**(5 mins)** | Hi <Student Name>!<br>Last class we had worked on creating a program which performs remote backup service for our files.<br><br>Could you think of important applications of this concept and how it might be useful? | **ESR:**<br>varied |
| | Today, we will be building a security program for our PC where we will capture a photo of anyone using our system every few minutes and then upload them to the remote cloud storage system simultaneously.<br><br>Do you understand how this will be useful? | **ESR:**<br>We will be able to capture the image of any unauthorized person using our system. |
| | You already know how to upload files on cloud storage.<br>We will quickly see how to capture images from a webcam using python and then you can build the project on your own! | - |
| **Teacher Initiates Screen Share** | | |
| **CHALLENGE**<br>• **Use opencv python library to take a snapshot using a webcam.** | | |
| **Step 2:**<br>**Teacher-led Activity**<br>**(15 min)** | You must have taken pictures using the software available on your PC.<br>What have you used? | **ESR:**<br>Varied |

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| | We can do that programmatically by using a library of python called OpenCV.<br>OpenCV is a huge python library which can be used to capture images, manipulate images and perform other kinds of image processing works. We will be using OpenCV here to capture image from our webcam | - |
| | Lets install the OpenCV library to our system.<br>We will use **pip3**, the python package manager to install the library.<br><br>*<Teacher opens the terminal and writes command **pip3 install opencv-python** and also helps the student install the library>*<br>*<Teacher runs the following code to take snapshot using webcam and shows the output to the student>*<br>Code:-<br>**import cv2**<br><br>**def take_snapshot():**<br>**#initializing cv2**<br>**videoCaptureObject = cv2.VideoCapture(0)**<br>**result = True**<br>**while(result):**<br>**#read the frames while the camera is on**<br>**ret,frame = videoCaptureObject.read()**<br>**print(ret)**<br>**#cv2.imwrite() method is used** | *<Student installs the library using command pip3 install opencv-python>*<br>*<Student observes and asks questions>* |

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| | **to save an image to any storage device**<br><br>**cv2.imwrite("NewPicture1.jpg",frame)**<br>**result = False**<br><br>**# releases the camera**<br>**videoCaptureObject.release()**<br>**#closes all the window that might be opened while this process**<br>**cv2.destroyAllWindows()**<br><br>**take_snapshot()** | |
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| | *<Teacher shows the code to student>*<br>As you can see in the first line I have **imported cv2**<br>Code:<br>**import cv2** | *Student listens and asks questions.* |
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| | Then a take_snapshot function has been defined.<br>Inside the function a new videoCaptureObject is created.<br><br>Code:-<br>import cv2 | - |

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| | def take_snapshot():<br>#initializing cv2<br>**videoCaptureObject = cv2.VideoCapture(0)**<br><br>This will start the webcam. | |

```
1  import cv2
2
3  def take_snapshot():
4      #initializing cv2
5      videoCaptureObject = cv2.VideoCapture(0)
```

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| | In the next line a result variable has been declared and its value has been set to True.<br>Then a while loop has been initiated.<br><br>def take_snapshot():<br>#initializing cv2<br>videoCaptureObject = cv2.VideoCapture(0)<br>**result = True**<br>**while(result):** | |

```
1  import cv2
2
3  def take_snapshot():
4      #initializing cv2
5      videoCaptureObject = cv2.VideoCapture(0)
6      result = True
7      while(result):
```

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| | In the while loop, to read the frames, read() method is used<br>ret,frame = videoCaptureObject.read() | |

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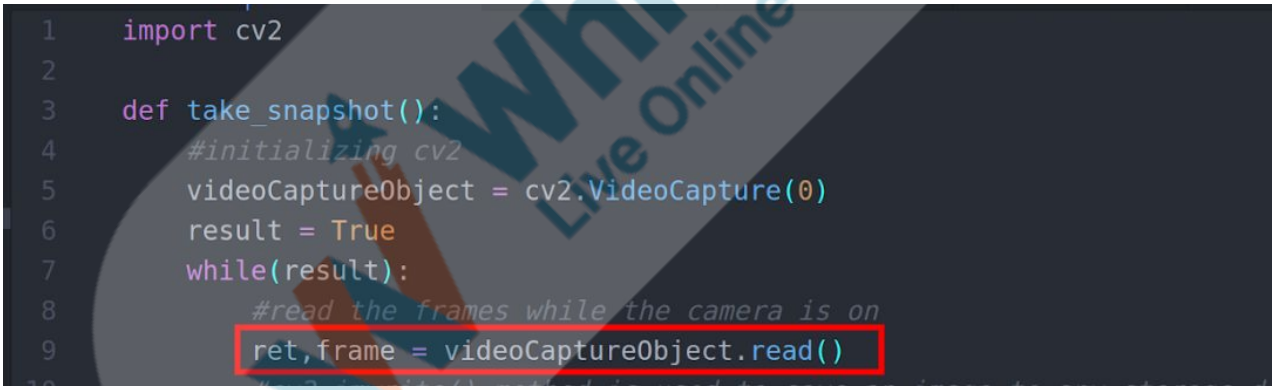
| | Here ret is a dummy variable which returns a boolean value, basically to tell us if something is being returned or not.<br>And the frame has the frame of the video.<br><br>Code:-<br>def take_snapshot():<br>#initializing cv2<br>videoCaptureObject = cv2.VideoCapture(0)<br>result = True<br>while(result):<br>#read the frames while the camera is on<br>**ret,frame = videoCaptureObject.read()** | *<Student observes and asks questions.>* |

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| | Code:-<br>def take_snapshot():<br>#initializing cv2<br>videoCaptureObject = cv2.VideoCapture(0)<br>result = True<br>while(result):<br>#read the frames while the camera is on | *Student observes and asks questions.* |

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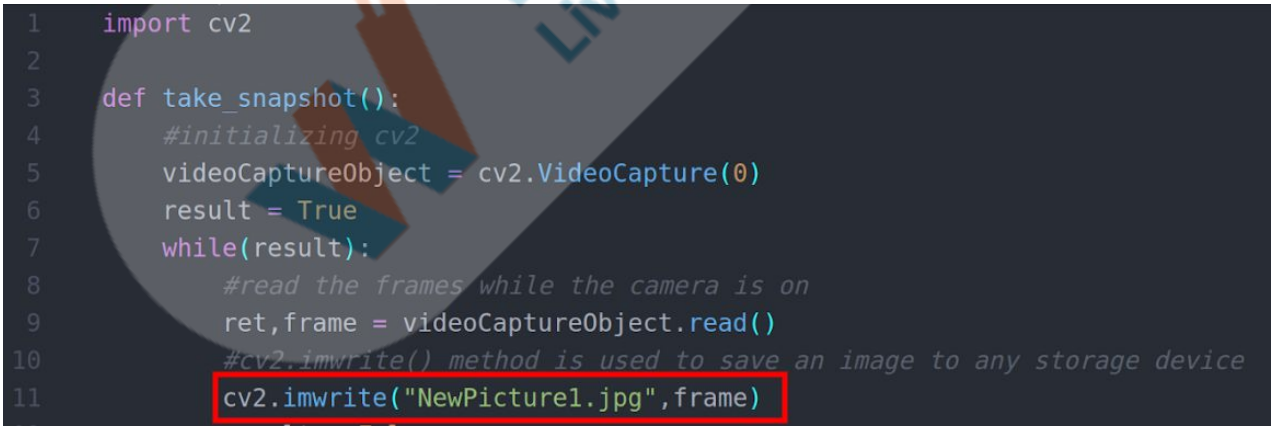
| | ret,frame = videoCaptureObject.read()<br>#cv2.imwrite() method is used to save an image to any storage device<br><br>**cv2.imwrite("NewPicture1.jpg",frame)**<br>**result = False**<br><br>Here cv2.imwrite() method is used to save an image.<br><br>Syntax: cv2.imwrite(filename, image)<br>It takes 2 Parameters:<br>-filename: A string representing the file name. The filename must include image format like .jpg, .png, etc.<br>-image: It is the image that is to be saved.<br><br>And after that result has been set to False to break the while loop. | |
| |  <br>```<br>import cv2<br><br>def take_snapshot():<br>    #initializing cv2<br>    videoCaptureObject = cv2.VideoCapture(0)<br>    result = True<br>    while(result):<br>        #read the frames while the camera is on<br>        ret,frame = videoCaptureObject.read()<br>        #cv2.imwrite() method is used to save an image to any storage device<br>        cv2.imwrite("NewPicture1.jpg",frame)<br>``` | |
| | Code:-<br>import cv2 | *Student observes and asks questions.* |

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| | videoCaptureObject = cv2.VideoCapture(0)<br>result = True<br>while(result):<br>ret,frame = videoCaptureObject.read()<br><br>cv2.imwrite("NewPicture.jpg",frame)<br>result = False<br>**videoCaptureObject.release()**<br>**cv2.destroyAllWindows()**<br><br>To close the webcam the **release()** method is used. And to close any opened windows by the camera **destroyAllWindows()** method is used. As the name suggests it destroys all the created windows. | |

```
import cv2

def take_snapshot():
    #initializing cv2
    videoCaptureObject = cv2.VideoCapture(0)
    result = True
    while(result):
        #read the frames while the camera is on
        ret,frame = videoCaptureObject.read()
        #cv2.imwrite() method is used to save an image to any storage device
        cv2.imwrite("NewPicture1.jpg",frame)
        result = False

    # releases the camera
    videoCaptureObject.release()
    #closes all the window that might be opened while this process
    cv2.destroyAllWindows()
```

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| | After that the take_snapshot function has been called. | *<Student observes and asks questions>* |
|  <br> | | |
| | There are other modules like time and random.<br>time.time() module returns time in seconds and the random module helps us generate random numbers. To use these modules we need to import them first.<br><br>*<teacher runs the following code in python shell>*<br>Code:-<br>import time<br>import random | *<Student observes and asks questions>* |

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| | print(time.time())<br>print(random.randint(0,9) | |

```
ashura@zeros:~/Documents/c102$ python3
Python 3.8.2 (default, Apr 27 2020, 15:53:34)
[GCC 9.3.0] on linux
Type "help", "copyright", "credits" or "license" for more information.
>>> import time
>>> import random
>>> print (time.time())
1591575871.1234708
```

```
>>> print(random.randint(0,9))
5
>>>
```

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| | Now we know how to take a picture through code. Here's a challenge for you.<br>Can you try to write code to take a picture every 5 mins and upload it on dropbox? | **ESR:**<br>YES |
| | **Teacher Stops Screen Share** | |
| | Now it's your turn. Please share your screen with me. | |

- **Ask Student to press ESC key to come back to panel**
- **Guide Student to start Screen Share**
- **Teacher gets into Fullscreen**

**ACTIVITY**

- **Write a program which takes snapshot through webcam every few minutes and uploads on a remote cloud storage**

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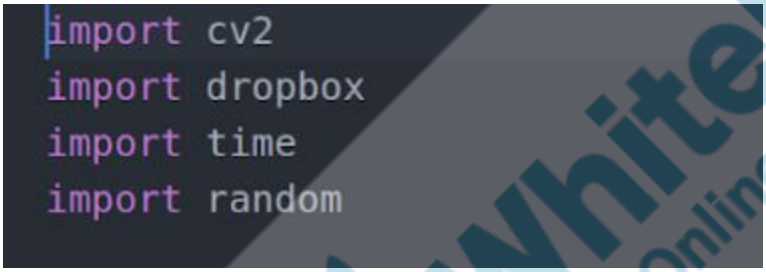
| **Step 3: Student-Led Activity (15 min)** | *<Teacher helps student create a* ***capture_and_uploadImage.py*** *file.>* | *<Student opens the editor and creates a file named* ***capture_and_uploadImage.py****>*<br>*<Student writes code to take picture using webcam and save it>* |
| | *<Teacher helps student write code for* ***take_snapshot*** *function which uses random number to generate random id for images and returns path of the image>* | *<Student writes code for take_snapshot function>* |



```
import cv2
import dropbox
import time
import random
```

```
start_time = time.time()

def take_snapshot():
    number = random.randint(0,100)
    #initializing cv2
    videoCaptureObject = cv2.VideoCapture(0)
    result = True
    while(result):
        #read the frames while the camera is on
        ret,frame = videoCaptureObject.read()
        #cv2.imwrite() method is used to save an image to any storage device
        img_name = "img"+str(number)+".png"
        cv2.imwrite(img_name, frame)
        start_time = time.time
        result = False
    return img_name
    print("snapshot taken")
    # releases the camera
    videoCaptureObject.release()
    #closes all the window that might be opened while this process
    cv2.destroyAllWindows()
```

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| | *<Teacher helps the student write the **upload_file** function which takes the path from the take_snapshot function and uplaods the images to dropbox>* **Note**: in the files_upload method add a parameter **mode=dropbox.files.WriteMode.overwrite** to resolve the path errors | *<Student codes to write the upload_file function which takes path from the take_snapshot function and uploads it on the dropbox>* |

```
def upload_file(img_name):
    access_token = "riFu6Ybhc9AAAAAAAAAAIJ_A5fl-EVHtEp33bdEjXapu5jLJLT38D6g_Hz25genB"
    file =img_counter
    file_from = file
    file_to="/newFolder1/"+(img_name)
    dbx = dropbox.Dropbox(access_token)

    with open(file_from, 'rb') as f:
        dbx.files_upload(f.read(), file_to,mode=dropbox.files.WriteMode.overwrite)
        print("file uploaded")
```

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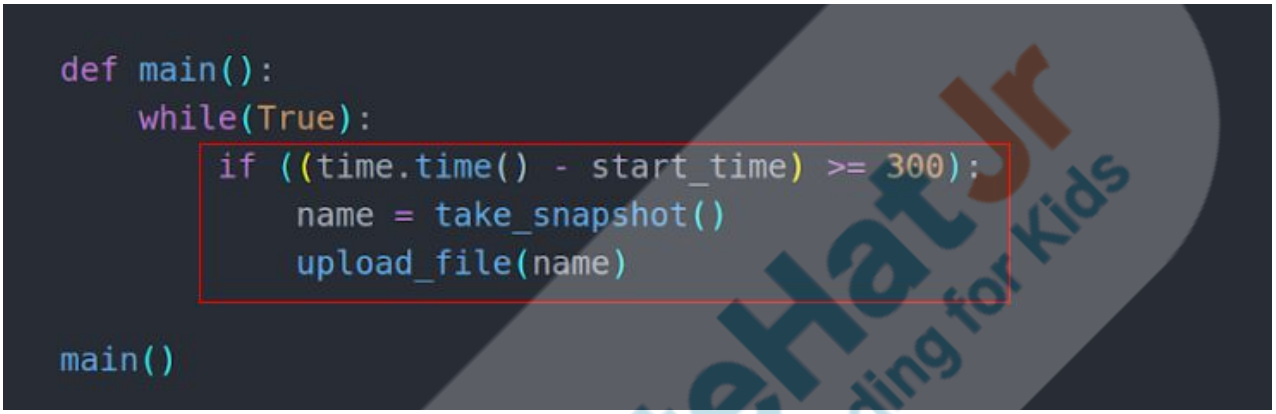
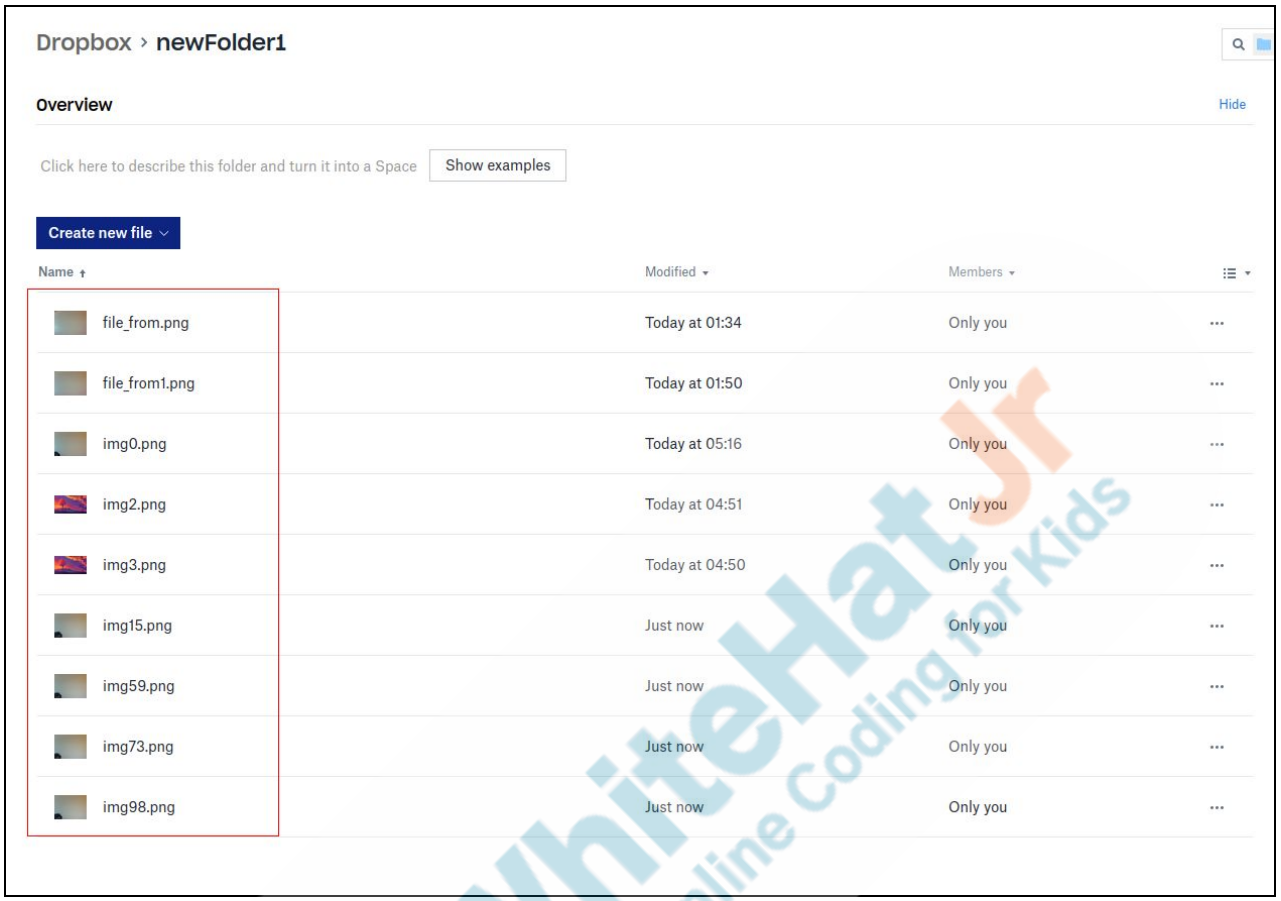
| | *<Teacher helps student define a **main** function which after every 5 mins calls the take_snapshot and upload_file functions>*<br>And then call the main function. | *<Student writes the main function which after every 5 mins takes a picture and uploads on dropbox.>* |
|  <br>```<br>def main():<br>    while(True):<br>        if ((time.time() - start_time) >= 300):<br>            name = take_snapshot()<br>            upload_file(name)<br><br>main()<br>``` | | |
| | Now run and test the code. | *<student runs and tests the code>* |




| Teacher Guides Student to Stop Screen Share | | |
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| **FEEDBACK**<br>• **Appreciate the student for their class**<br>• **Get them to play around with different ideas, automations which they can build for their system using python** | | |
| **Step 4:**<br>**Wrap-Up**<br>**(5 min)** | Let's quickly wrap up today's class.<br>What did we learn? | **ESR:**<br>- We learned about the OpenCV library in python<br>We learned about the different methods of the OpenCV library such as imwrite() etc.<br>- We also learned about time and random module. |
| | You can actually do a lot of things using the OpenCV library.<br>Try to explore more on your own.<br>In the next class we'll be starting a new project.<br>Excited for it? | **ESR:**<br>Yes! |
| | Up next, we have to dive into the capstone class. It's time to put your creative skills to test.<br><br>In the upcoming class, we will draw histograms, line plots and scatter plots to visualize Internet users data from different countries.<br><br>Please request your parents to join the class. | |

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| **Teacher Clicks**   | | |
| **Additional Activities** | *Encourage the student to write reflection notes in their reflection journal using markdown.*<br><br>Use these as guiding questions:<br><br>● What happened today?<br>- Describe what happened<br>- Code I wrote<br>● How did I feel after the class?<br>● What have I learned about programming and developing games?<br>● What aspects of the class helped me? What did I find difficult? | *The student uses the markdown editor to write her/his reflection in a reflection journal.* |

| Activity | Activity Name | Links |
|---|---|---|
| Teacher Activity 1 | Final Solution | https://github.com/whitehatjr/Automation |