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IMPROVISED PROCTORING FOR ONLINE EXAMS USING PYTHON

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Abstract
The objective of the project is to detect the activity of the person in online exams and video conferencing. It has been observed that in Computer Based Tests (CBTs) and in online meetings (such as conferences, interviews etc.,), the participants tend to move out of the field of view. So, it shows that the participants are not active. This disrupts the flow of the meeting. In CBTs it can also lead to malpractice.
To overcome this problem, we use motion detection technology. Motion detection is the detection of the change in the position of an object with respect to its surroundings and vice-versa. Every time a motion gets detected, our detector will give a message regarding this activity. The Eye ball detection is added as improvisation to the regular proctoring activity which monitors the movement of eyeballs and reduces malpractice.
Motion detectors are mostly used for CBTs, intruder alarms, to count how many cars have passed through a toll gate, at automatic ticket gates, etc. Additionally, motion detection technology has also been used in automatic doors, entryway lighting, and to detect thefts as the object moves out of the field of view.

Keywords: Motion detection, Background subtraction, Grayscale conversion, Eyeball detection

I. Introduction

Motion detection is the detection of the change in the position of an object with respect to its surroundings and vice-versa [1]. The approach is explained here. When the program starts, we will capture a picture called baseline image. The program will keep comparing the new frame with this baseline image. The contents of the image will be different and if this difference is beyond a certain threshold, the program will treat it as motion detected.
Motion detection technology has recently gained a tremendous amount of popularity. It is used in intruder alarms, entryway lights, motion detector lights, automatic ticket gates, automatic doors etc. It is also used in many applications based on machine vision, motion detection is used (refer Fig 1). For example, when we want to count the number of people who pass by a certain place or how many cars have passed through a toll gate.

Figure 1: Motion Detection

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II. TECHNOLOGY USED

2.1 Software and Hardware Requirements

HARDWARE REQUIREMENT:

Webcam: 8MP
Processor: Intel® Core™ i5
Hard disk: 1TB

SOFTWARE REQUIREMENT:

Microsoft windows 10 (64- bit)
IDLE (Python 3.9).
Python 3.9(64-bit) Visual Studio Code
Windows 64-bit to write the code, compile and execute.

III. DESIGN ANALYSIS

3.1 Block Diagram

This is the Architecture or block diagram (Fig 2) of the program. It shows us the basic components and the steps that are required in this project. The webcam is used to obtain the input which is later processed and the grayscale format is produced. Upon the creation of the grayscale image, motion can be easily detected as the changes are clearly visible in the background subtracted image

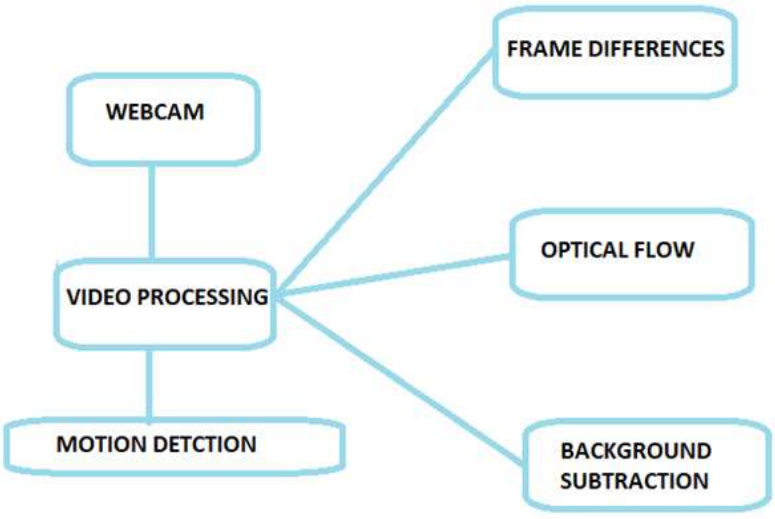

Figure 2: Block diagram

3.2 Flowchart

This flowchart (Fig 3) is used to represent the process of motion detection in a graphical format. The pre-recorded or live video is first shown as a separate frame for convenience of detection.

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Alongside this frame, its respective grayscale video is also displayed. Subsequently, background subtraction and motion detection can be observed from this flowchart.

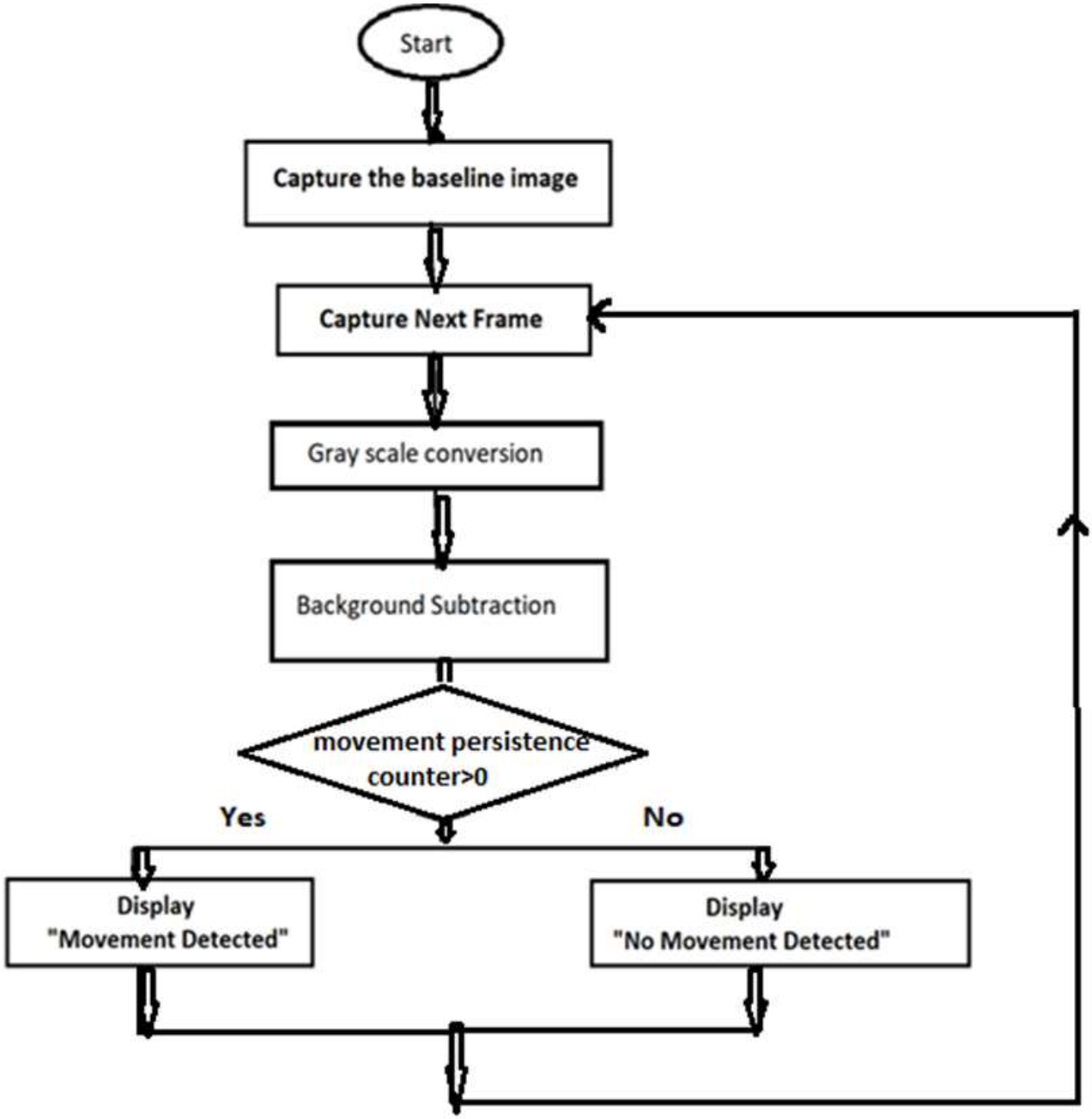

Figure 3: Flowchart for motion detection

3.3 Use case Diagram

Use case diagram, also referred to as a behavior model or diagram is used to show the relationship between the users and the different processes that take place in this project. The various steps that are taken to achieve the detection of motion are shown below.

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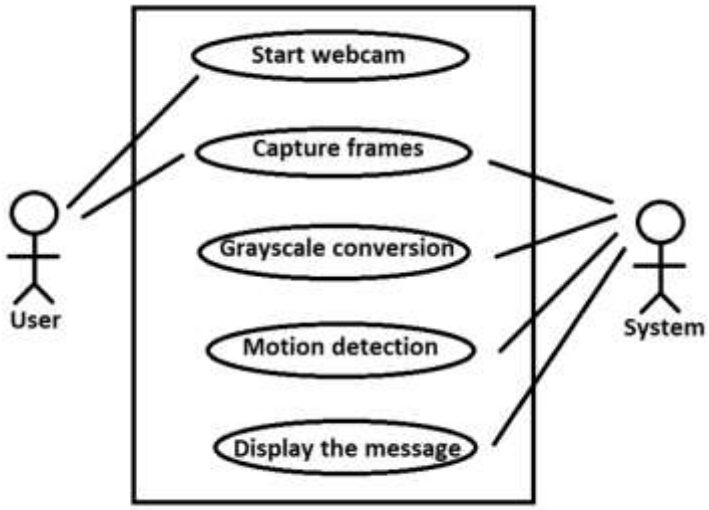

Figure 4: Use case Diagram

3.4 Class Diagram

A class diagram (Figure 5) in the Unified Modeling Language (UML) is a type of static structure diagram that describes the structure of a system by showing the system's classes, their attributes, operations (or methods), and the relationships among objects. The various classes, their attributes along with the respective methods required for motion detection are shown in the diagram below.

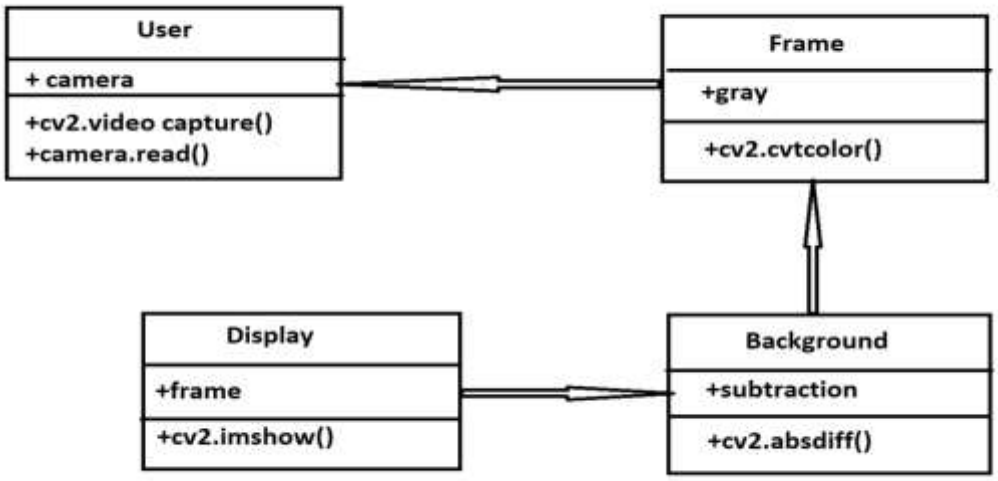

Figure 5: Class Diagram

3.5 Deployment Diagram

Deployment diagrams are used to visualize the topology of the physical components of a system, where the software components are deployed. These diagrams (Figure 6) are used for describing

the hardware components and show how they are deployed in the software. They also describe the runtime processing nodes. The nodes and relationships between these nodes for motion detection are shown in the diagram below.

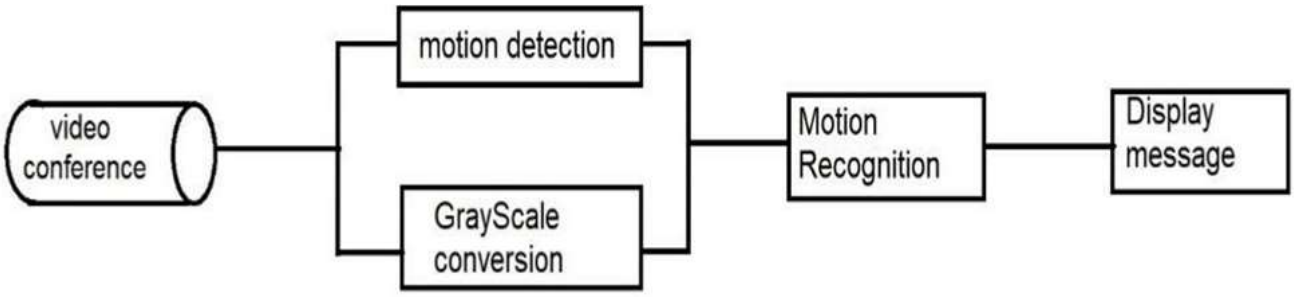

Figure 6: Deployment Diagram

3.6 APPLICATIONS

Motion can be detected through various means such as infrared, sound, and vibration. Motion detectors are primarily used for detecting moving objects (especially people), and gathering data regarding position, acceleration, and velocity.
Motion detectors most commonly use an infrared detection sensor, which can be incorporated into various devices found around us. This sensor provides data about motion, using which the device can alert the user of motion in the area or perform certain tasks. For example, a motion detector attached to a burglar alarm detects motion and enables the alarm to alert the home owners, or to activate a camera [5].

Some of the key applications of motion detectors include:

- Intruder alarms
- Automatic ticket gates.
- Entryway lighting.
- Security lighting
- Automated sinks/toilet flusher
- Hand dryers
- Automatic doors.

IV. PROCEDURE

Testing is a method to check whether the actual software product matches expected requirements and to ensure that the software product is Defect free. It involves execution of software/system

components using manual or automated tools to evaluate one or more properties of interest. The purpose of software testing is to identify errors, gaps or missing requirements in contrast to actual requirements [2].

- Capture the baseline frame
- Convert the frame to Gray.
- Smoothen the frame to remove noise.
- Capture the new frame
- Convert the frame to Gray.
- Calculate the difference between the two frames.
- If the difference is greater than the threshold, assume motion is detected.[3]

The next step is to deduce the difference between the baseline and the new frame. We pass the two images to the cv2.absdiff() function.

The image is converted into a binary image using a method called Image Thresholding meaning, if a particular pixel value is greater than a certain threshold (specified by us here as 35), it will be assigned the value for White (255) else Black(0).

Now we have an image which has only 2 types of pixels (pure black or pure white, nothing in between). This is done so that we can identify the contour region around our detected object. We will use this to draw a green box around the object in the frame.

Now we will find all the contours in our binary image. Contour is simply a curve drawn along the perimeter or boundary having the same color or intensity. In essence, it will draw a curve around the white area on the black background. It expects the background to be black and the foreground object to be white.

Using the cv2.findContours() method we will identify all the contours in our image. This method expects 3 parameters: (a) image, (b) contour retrieval mode and (c) contour approximation method.

This method returns the list of contours identified. We are using the cv2.contourArea() method to filter out any small contours that may not be of any interest to us.

The cv2.boundingRect() returns the (x,y) coordinates of the top left corner along with the width and height of the rectangle containing the particular contour. We are then drawing a rectangle to show it on the screen.

V. RESULTS

The project was successfully implemented and the screenshots of the output are depicted below.

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Figure 7: No Movement detected

If the frame of the webcam is empty, that is there is no subject in the video or if there is an absence of movements, it signifies that the movement on the scale will be displayed as 0. Also the gray frame on its side will look black in the absence of a subject. The gray frame isn't completely black in the presence of a stationary subject, it will show the outline of the non-moving subject in gray and simultaneously display the movement to be 0. (Here, the subject can refer to the attendee or user of the video conference).

Figure 8: Movement detected

If the user starts his webcam, a new frame will open in the background which detects motion. This is done based on grayscale conversion and background subtraction processes. It also enables the user to see the extent of movement on a scale of 0 to 100. 0 stands for no movement detected whereas 100 represents the highest amount of movement detected.

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Figure 9: Eyeball detection

VI. Conclusion

The objective of the project is to detect the activity of the person in online exams and avoid malpractice. Usually a proctor will be provided to monitor the participant in the exam. As it is difficult to observe the participant every second, we have implemented this project where the movement of the participant is monitored.

Python programming language is an open-source library-rich language that provides a number of applications to its user[4]. OpenCV is an open-source library that can be used with many programming languages, and by integrating it with Python's libraries we made the best use of the OpenCV features.

When an object is motionless and has no speed, then it is considered to be at rest. And just the opposite is when an object is not at complete rest. Then it is considered to be in motion.
The program displays a message whether the motion is detected or not. The improvised eye ball detection to observe the eyeball movement is also successfully implemented. In this way, we can help proctor and avoid malpractice in the online exams.

References

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