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Dlib and YOLO Based Online Proctoring System

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Abstract: This paper discusses the work on online proctoring system capable of detecting malicious activities or malpractice during online examination. Proctoring involves detecting examinee action using the help of a webcam and in-built microphone. Since the academic practices are moving towards digital media, this system removes the need of any human proctor. Candidate eye tracking, lip movement analysis, presence of second person, detecting any electronic gadgets used for malpractice are taken care of by the system along with the necessary warning, along with visual analysis, audio analysis done and it's compared against the answers associated with the exam.

Keywords: Proctoring, Malpractice, You Only Look Once, Person Detection, Head Pose Estimation.

I. INTRODUCTION

As technology is advancing, it is becoming easy to access the features of digital media. More and more schools, institutes are coming forward to provide their courses in online mode, assessment and evaluation can also be done online. There may be some issues arising using these practices which need the presence of a proctor as a catalyst for smooth flow of any examination reducing the practice of any malicious activities. With the advent of Covid-19 many schools and institutes have been closed and many meeting platforms like Microsoft, google, zoom are helping to provide a classroom like structure. Our project is to contribute to the current academic practices in online and to help maintain the quality of education. This system is designed to overcome these problems. It will try to identify various methods used for malpractices in exams. Using webcam and microphone the continuous monitoring is done. It will analyse body language of examinee to identify his activity.

II. RELATED WORK

Proctoring of online exams can be classified into three main categories that are (a) no proctoring, (b) online human monitoring, (c) semi-automated proctoring. In the no proctoring method [1] to avoid cheating various procedures will be followed such as increasing the difficulty level of the question papers. In online human monitoring, a proctoror has to sit and monitor the whole exam which is not a suitable approach and cost-efficient method. Instead of transmitting the whole video of the test taker, a snapshot will be taken at a certain interval of time to reduce the bandwidth usage [2]. In [3] by A.T. Awaghade, D. A. Bombe, T. R. Deshmukh and K. D. Takawane, the proposed paper contains work related to the measures and practices related to cheating. Combining the behavioural check and detecting malicious activity, which helps to create a system capable of proctoring without a human invigilation. The inbuilt camera in the pc can capture objects in the frame. Detection of any kind of device or machinery used for cheating. In the paper [4] an additional robot that contains a 360-degree camera and motion sensor is attached to the student computer through USB port. If any suspicious activity is captured then the robot will transmit the videos to the test center or record the video. for this semi-automated proctoring method, the test taker should have the robot attached with the computer. In the paper [5] the recording during the exam is converted into a certain minimalistic frame by eliminating duplicate or similar looking frames which saves the broadband instead of transmitting the video recordings.an hours of content will be reduced to some hundreds of frames.

An Image Matching and Object Recognition System using Webcam Robot uses Computer Vision (CV) for object detection. All objects in the frame are captured and stored or the detection can be performed against a defined set of objects given by the user. Any movement of an object or introduction of new objects in the frame is also detected and stored

III. WORKING

The main objective of proctoring is to avoid cheating during online exams. Cheating can be identified by Audio and visual based proctoring. By making use of computer vision the visual based proctoring can be done. Some of the visual based tracking's are, tracking the eyes, face and lip movements of the test taker. if the candidate uses any phones to cheat during the exam, can be identified. Additional people in the frame can also be detected. Usually if a person wants to

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cheat, he may look at written materials or any books which he kept along with him. Head movement along with eye is tracked based on that cheating can be identified and a warning can be given to the test taker. For the record purpose snapshots will be taken each time when the test taker tries to cheat. Other than referring and writing the answers, someone may dictate the answers during the exam. To identify this, Audio based proctoring is done. audio is recorded during the exam and also the recorded audio is converted to text using Google's speech recognition API. The spoken words by the test taker are compared with the question and answers. If there are more common words then warnings can be given to the test taker. Instead of recording audio of the test taker during the whole test, only when the lip movement of the test taker is detected then the recording will be started.

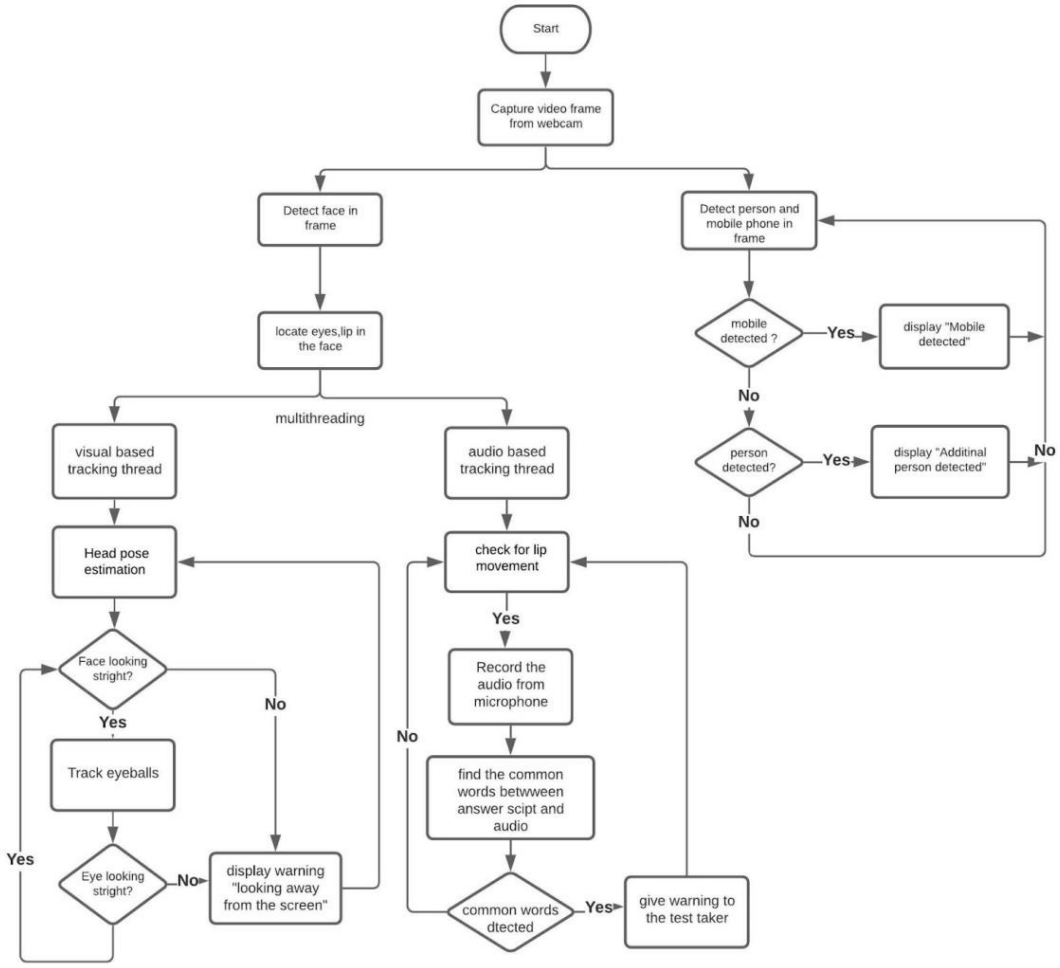

Fig. 1 Flow chart of online proctoring.

A. Eye tracking and Head pose estimation:

During the computer-based exam the test taker should not look other than the screen for a long time. In order to identify that , the eye and head pose of the test taker is tracked. If he looks left or right other than the screen then the warning messages can be given. Since it is not possible for a test taker to look at a mobile or book for answers in a single look , Short or sudden movements will be neglected. But frequent changes in the head pose for a sometime period will be considered as malpractice. Eye tracking will be done by making use of OpenCV and dilib 68-point face detector. The live video from the webcam of the test taker is taken. Initially faces will be detected using dlib face detector, i.e., 68 points on the face using that a Rectangle is drawn around the face. Using landmarks, the position of the eye is located in a frame. For the further processing only that part is taken. By applying a mask and a certain threshold eyeball is identified. Later the eyeball is tracked, based on the number of white pixels on each side, where the test taker is looking is identified. Warning also should be given on the basis of how frequently the test taker is looking away from the screen.

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B. **Lip movement detection and Audio based proctoring:**

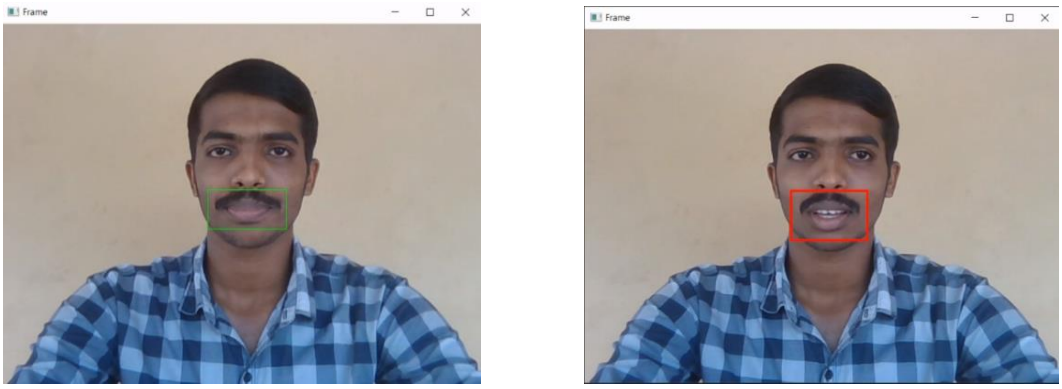
During the exam the test taker may ask the answers for the question with others, so that they can read out the answer without getting captured in the frame. To identify this type of cheating, when the test taker asks questions i.e., when he opens mouths then the recordings can be started so that in such a situation using audio-based proctoring, cheating can be identified. When the test taker opens his mouth the distance between the facial keypoints will vary. In this way we can identify whether the test taker is speaking or not. If the candidate is speaking then his voice is recorded. The audio is recorded for 10 seconds, when the test taker's lip movement is detected. The recorded audio is then converted into text by calling Google speech recognition API in different threads. After getting the converted text from Google API, using NLTK stopwords are removed.it will be compared with the text of the question-and-answer paper to identify the common words and display the common words. based on those warnings can be given to the test taker.

C. **Additional person and mobile phone detection:**

During the exam the test taker should not take any help from others. More people during the exam can be detected by using a trained model to detect the persons. Only the test taker should present during the exam and if it detects the multiple peoples then it will take a snapshot and also display the warning messages. In order to ask a question, usually people will take a picture of the question using their phone. So, this can be identified by using a trained model to identify mobile phones. Till the end of the exam only the test taker must be visible to the camera. If the test taker is also not visible to the camera during the exam, then that is also treated as a malpractice. And also, at that time a snapshot will be taken. Pre-trained weights of YOLOv5 trained on the COCO dataset are used to detect people and mobile phones during the exam.

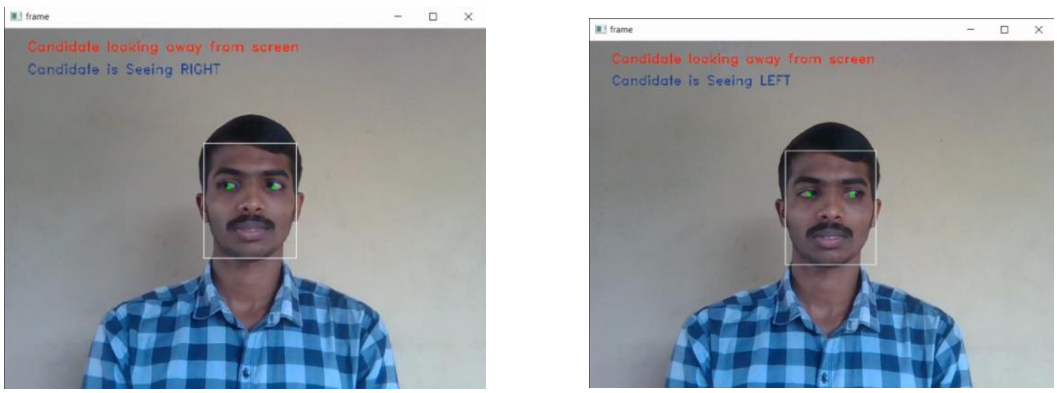
IV. RESULT ANALYSIS

For the experimental purpose this proctoring method is tested in different real time scenarios like different low intensity lighting conditions.



(a) Normal situation (b) speaking

Fig. 2 Lip movement detection If the lip movement is detected then it triggers the speech recognition system. Instead of recording the audio during the whole exam, when the candidate tries to speak, then only the system will record.



(a). Looking towards right (b). Looking towards left

Fig. 3 Eye movement tracking, which gives the warning when the candidate tries to Look towards right or left.

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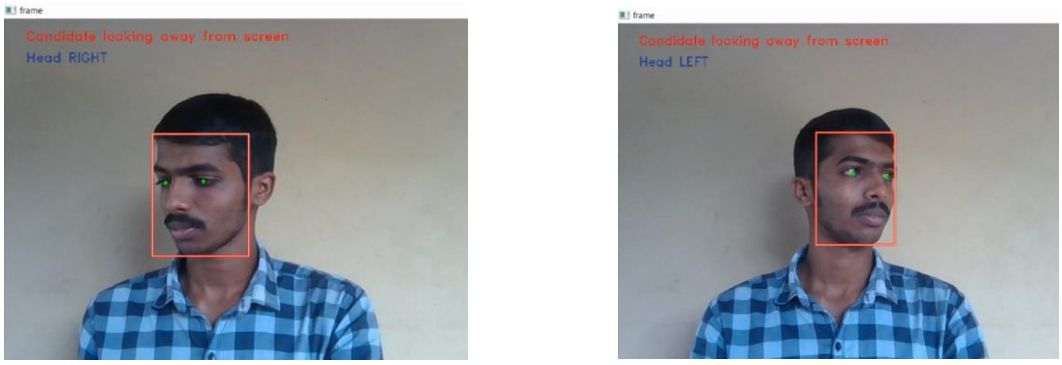
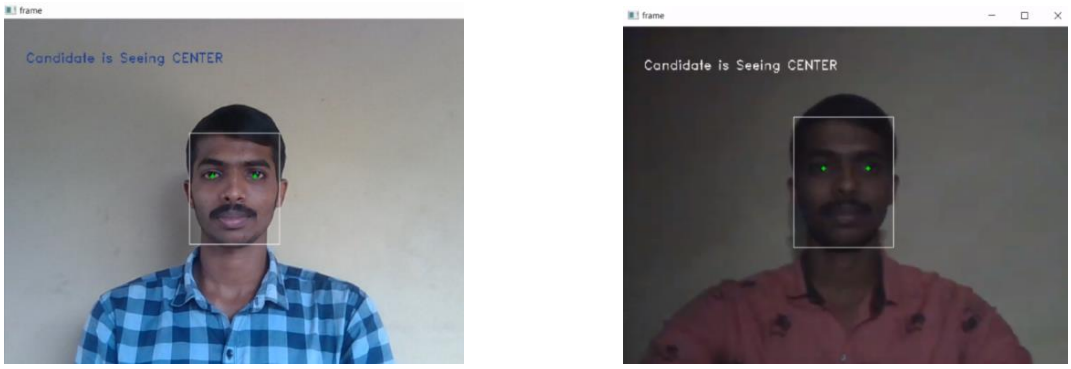


(a). Looking towards right (b). Looking towards left

Fig .4 Head pose Estimation, which prevents any possible malpractice by passing warnings when a candidate looks right or left. Other than the screen.



(a) (b)

Fig .5 Looking towards the center in different light intensity situations in normal light (a) and low intensity light(b).

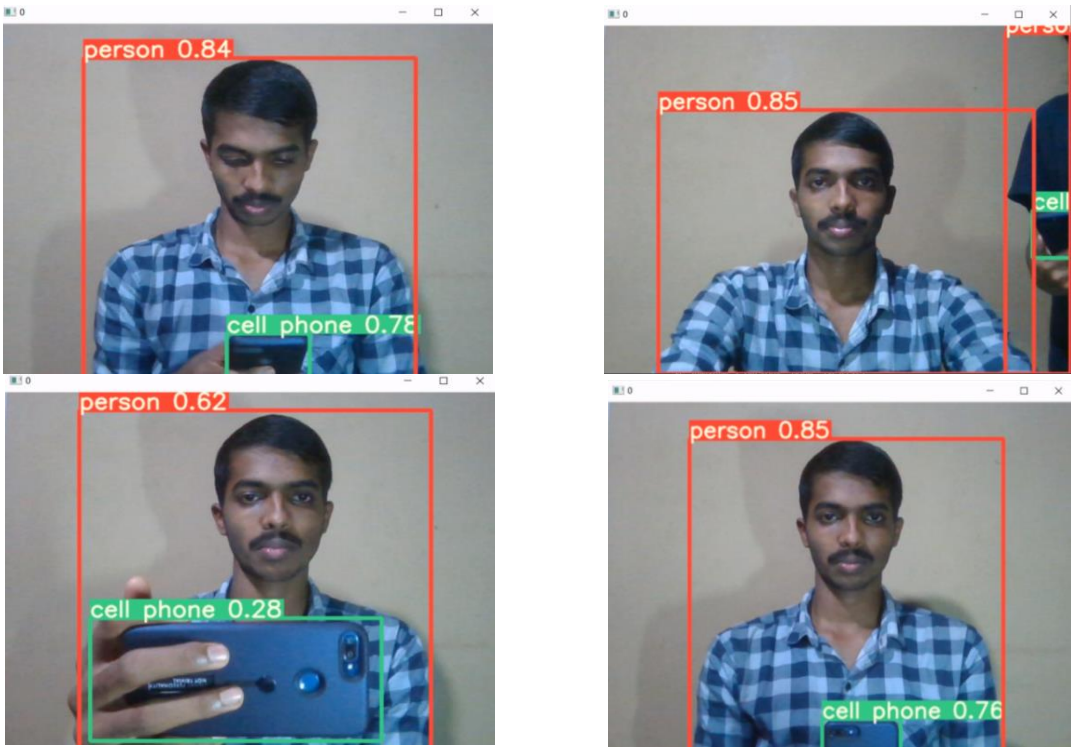


Fig. 6 Mobile and additional person detection using yolov5.

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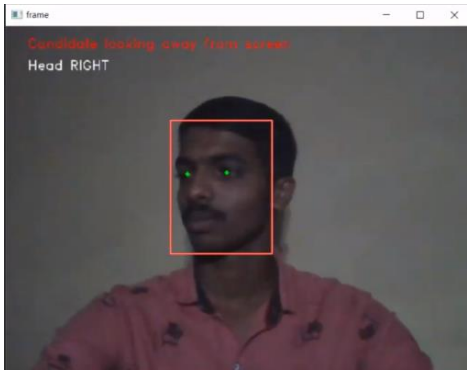
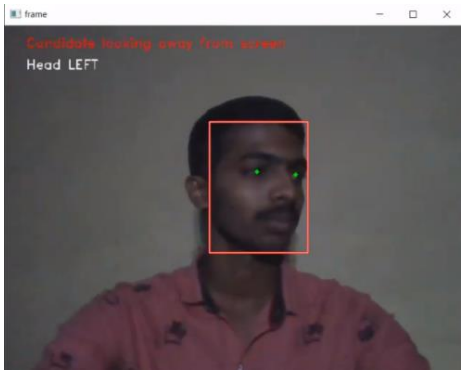
Fig .6 usage of mobile phones by the candidate is detected and also it detects the additional persons who are in the frame. Each time when the candidate tries to cheat by the above methods, the system will identify it and give warnings. Also each time when the candidate tries to cheat a snapshot will be taken



(c). Viewing towards right



(d).Viewing towards left

Fig .7 Head pose detection in low intensity light

V. CONCLUSION

This system is meant to eliminate the basic malicious techniques used in examinations. A web browser connected to this system is capable of providing secure exams. So, here the human proctoring is replaced by the software system which is effective, precise and efficient. Since the system is not using any external devices other than inbuilt microphone and webcam, this method of proctoring can be used anywhere and anytime.

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