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Automated Invigilation System Using MediaPipe and Haar Cascade Frontal Algorithm

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Abstract

Exams are the methods adopted by educational institutions to identify student's knowledge. Students adopt various ways to cheat in exams like answer sheet exchanging, copying etc, students cheat their way into getting good grades. Detection of cheating manually may not be efficient to identify and prevent cheating during examinations. So, to avoid this the process of invigilation is made automatic. Automated invigilation offers the best method for keeping an eye on the kids and spotting instances of malpractice right away. The proposed work has three phases. In the first phase, the exam management does processes like publishing time table, allocating exam hall, allocating hall to staff etc. In the second phase the posture detection of the student present in the exam hall is done using Computer Vision and Media Pipe to detect whether the student has involved in the malpractice. In the third phase, the emotion analysis and face recognition of the student is done using the Haar Cascade Frontal Algorithm. The proposed work also helps to eliminate impersonation in the exam hall.

Keywords: Malpractice, Impersonation, Computer Vision, MediaPipe, Haar Cascade Frontal Algorithm.

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1. Introduction

Exams serve as a tool for measuring students understanding and determining which subjects require extra work. In a traditional exam, there must be human invigilators present to keep an eye on the students while they are taking the examination. In this method, more invigilators are needed as the number of students increases. The requirements of this method are more human energy, time, and resources. Malpractice in exam has been a common occurrence worldwide, despite advancements in detection methods. Over the past ten years, numerous research has been undertaken on student cheating practices and potential solutions that institutions might try to implement. Exam cheating typically occurs for three reasons: fear of failing, lack of proper invigilation work and lack of concern for being caught. The student has complete control over the first reason, but there is some controllability over the second one. This occurs primarily as a result of insufficient or ineffective invigilation, or both. Because manual invigilation has so many drawbacks, automating the process makes it reliable and error-free. Objective of this Model is to automatically identify irregular or exam- cheating behaviors. In the method, this is accomplished by identifying the student's body posture throughout the exam using the classroom's CCTV footage. It is possible to spot actions that might be considered as cheating, such as turning around or bending. A report is provided to the examiners and it is concluded that cheating has occurred if the number of such cases discovered exceeds a predetermined threshold. The examiner can have a second opinion to this issue to reach a final judgement. The proposed work's main goal is to collect video from the exam hall and then analyse the data to look for any indications of suspicious activity. Face detection is a phase that must come before face recognition in order to spot impersonation in a testing environment. Face detection also requires tracking facial features in video sequences. The student who is doing malpractice is identified using facial recognition, and the examiners receive a report on their actions along with a timestamp after they have reviewed the report.

2. Background

Malpractices in exam hall is one of the main problems faced by educational institutions. In traditional exam invigilation, a human invigilator must present in the exam hall to monitor the students writing the exam. This requires lots of labour, energy, and time and also it is not efficient as the invigilator sometimes not able to monitor all students. Modern techniques of invigilation include the usage CCTV cameras and monitor the exam hall using the CCTV

visuals. This is not at all an efficient way because it needs reviewing the whole visuals to detect malpractices. This also requires lot of time, energy and cost. Impersonation in the exam hall is one of the major issues in competitive exams. The existing system includes the manual monitoring for impersonation identification. So, the proposed work will create a new revolution in the exam invigilation process by making the process automated.

3. Related Works

This kind of research assists in the early detection of academic dishonesty. The phrase "actions of student cheating in paper-based exams" provides a brand-new dataset. The dataset consists of suspicious behaviours that occurred in a testing set. Eight different actors represented the five various types of cheating. Each pair of subjects engaged in five different types of dishonest behaviour. The project is being developed for a system based on computer vision. The purpose of this effort is to develop a multimedia analysis system that can recognize and categorize different behaviours suggestive of exam-taking fraud. The model involves extracting five well-known features and scaling each frame in the dataset. To encode the visual occurrences Data in each frame, a visual language codebook for each sort of feature is developed using words of various sizes. Finally, the defined characteristics are classified using a support vector machine. Since many activities seem to be relatively similar and include acts that are not primarily dependent on bodily movement, the dataset comprises very difficult video sequences. The method is designed to identify cheating behaviours in tests that use paper and pencil. Since many activities seem to be relatively similar and include acts that are not primarily dependent on bodily movement, the dataset comprises very difficult video sequences. The experiments using the framework produced impressive and significant results. 91% of the time, the cheating recognition model successfully identified the cheating behaviours. There are a number of ways through which work could be improved because the outcomes were optimistic and distinctive. For learning, for instance, more complicated algorithms like deep learning might be utilized, and for classification, more suitable features and classifiers. The system can be improved in the future to catch cheaters in multi-subject online tests. Additionally, the proposed dataset was only collected in one nation, and each nation has a unique examination environment.

4. Data Collection

The details of the student are data that is required for this system. The staff associated with a particular class can add the details of the students in that particular class. Details like name, course, register number etc are added to the system along with three images of the student. These images are used for the face recognition to identify the student involved in the malpractice and to mark the attendance to eliminate impersonation.

5. Proposed Work

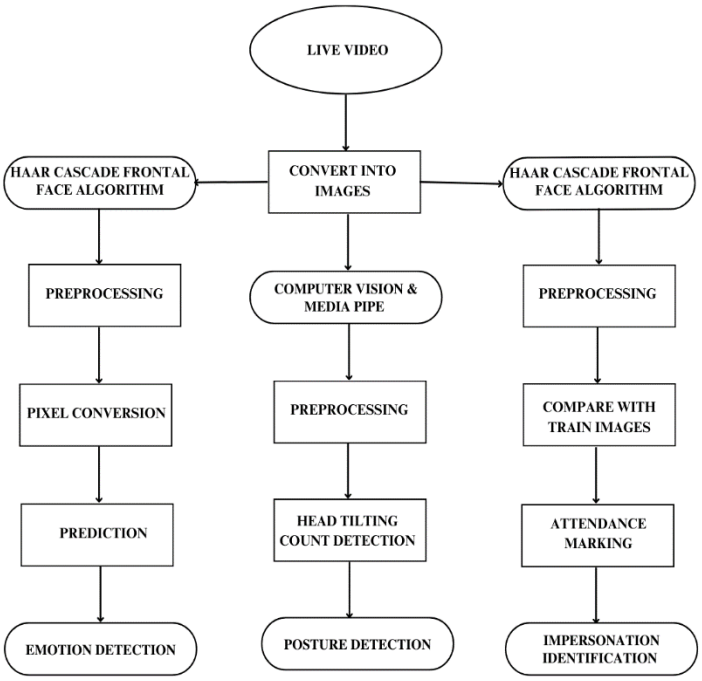

Figure 1. System Architecture

5.1 Admin Module

The admin can login to the system using valid credentials and can perform the overall management of the system. The admin can add, edit, and delete staffs, and is also capable of adding courses, subjects, exams and allocate halls for exam. The admin allocates one staff per hall and publishes exam time table. The admin can assign duties and subjects to staff and can view the malpractices that happened in the exam hall.

5.2 Staff Module

The staff can login to the system using the login credentials. The staff can add students into the system and view the hall that is allocated by the admin to that particular staff. The staff can also upload notes, model question paper, and view the work assigned by the admin. The staff can also view the attendance of the student and can view the malpractices that happened in the exam hall.

5.3 Student Module

The student can login to the system using the login credentials. The student can view the notes, model question paper that is uploaded by the staff and can view the exam details.

5.4 Malpractice Detection Module

This module is responsible for detecting malpractices. This module further classified into sub modules such as head movement detection using Computer Vision and MediaPipe, emotion analysis and face recognition using Haar Cascade Frontal Algorithm. The live video from the examination hall is captured using CCTV cameras and the video is converted into images. Image preprocessing is done on these images to use by the above mentioned algorithms.

5.4.1 Head Movement Detection Using Computer Vision and MediaPipe

Posture detection using computer vision is a technique that leverages computer vision algorithms and techniques to analyze and interpret the body's position and alignment in real-time. MediaPipe is a framework of computer vision. Computer vision can be accessed using MediaPipe. For this method, the CCTV camera is required and the footage from the camera is fed to the model as input directly in real time for analysis. This method converts the video into individual frames. The algorithm does the preprocessing of the images and locates different points on the head and the movement of the head is detected by calculating its changes in X and Y coordinates. If the head movement is abnormal for a period of time, then the system detects it as a possible case of malpractice. The system detects the head movements with an accuracy of 97%.

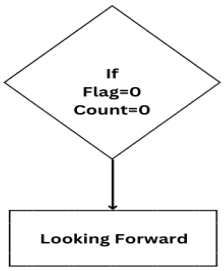

Figure 2. Head position detection- Forward

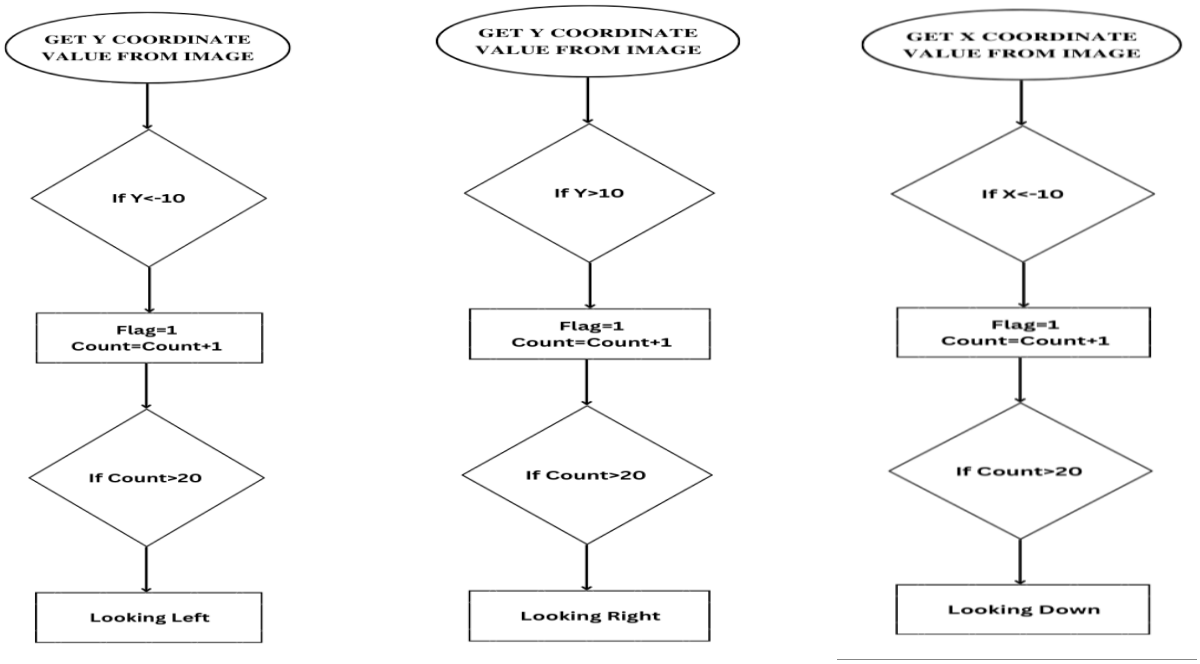

Figure 3. Head Position Detection- Left, Right, Down

5.4.2 Emotion Analysis and Face Recognition using Haar Cascade Frontal Algorithm

The emotion of the student in the examination hall is analyzed to identify whether the student actually has mindset to do malpractice. The same images that are passed to the posture detection model is used in this. Image preprocessing is done by the algorithm. Seven emotions are initialized in the model. angry, disgust, fear, happy, sad, surprise, neutral. The images are then converted into pixel counts. pixels are in scale of [0, 255]. normalize all pixels in scale of [0, 1]. The emotion is detected using the change in pixel count and based on this, a prediction

is made on the emotion. The proposed system achieves 66% accuracy in predicting the emotion.

Impersonation in exam halls can be detected through this system. Haar Cascade Frontal Algorithm is used to recognize the face of the student present in the exam hall and it is compared with the already stored train images. The attendance of the student is automatically marked by comparing the faces of the students in the exam hall and already stored train images. The mismatched faces will be marked as absent and this reduces the possibilities of impersonation.

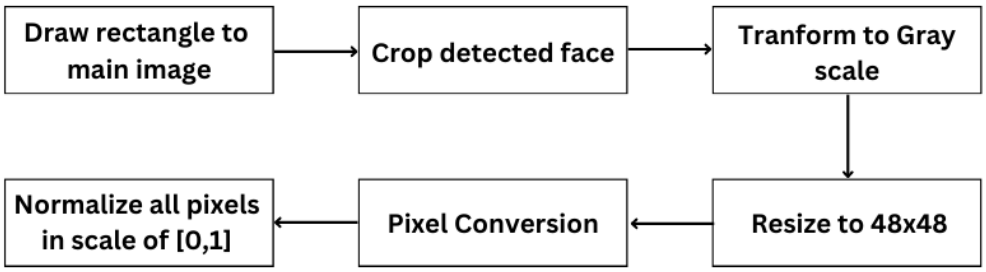

Figure 4. Image Preprocessing

5.4.3 Report Submission

Once the malpractice is detected from the previous methods, the report of malpractice is available on the website along with the name of the student involved in the malpractice, date and time of the happened malpractice and images of the malpractice that is done by the student. The emotion of the student at the time of malpractice is available in the database. All the students present in the exam hall will be marked as present by comparing the faces with already stored train images. The mismatched faces will be marked as absent. This eliminates impersonation in the exam hall. The CCTV footage can check again easily as the time of malpractice is available so there is no need to review the entire footage.

6. Experimental Result

Input: Live video from the examination hall.

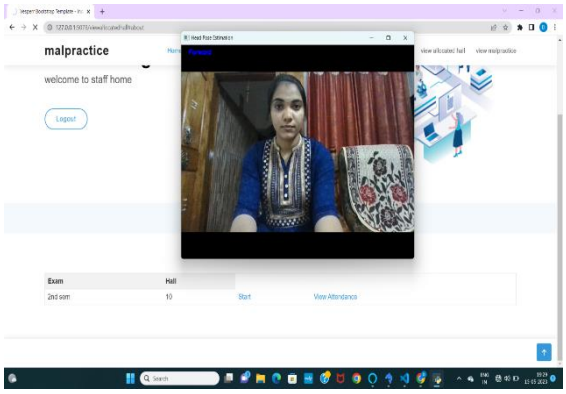

Figure 5. Looking Forward

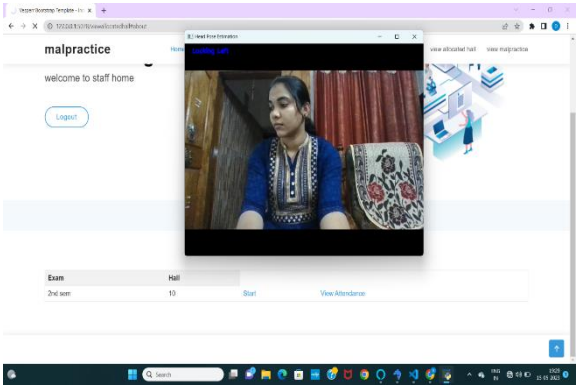

Figure 6. Looking Left

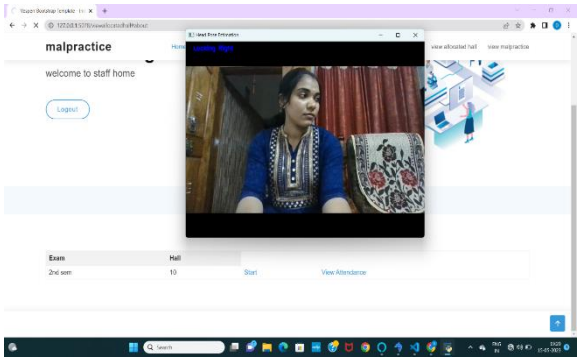

Figure 7. Looking Right

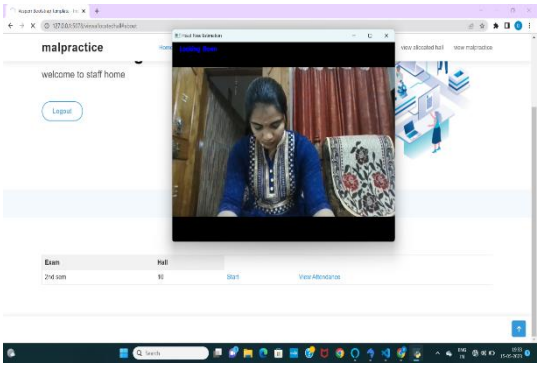

Figure 8. Looking Down

Output: If the head position seems to be abnormal for a long period of time, then system will detect it as possible case of malpractice.

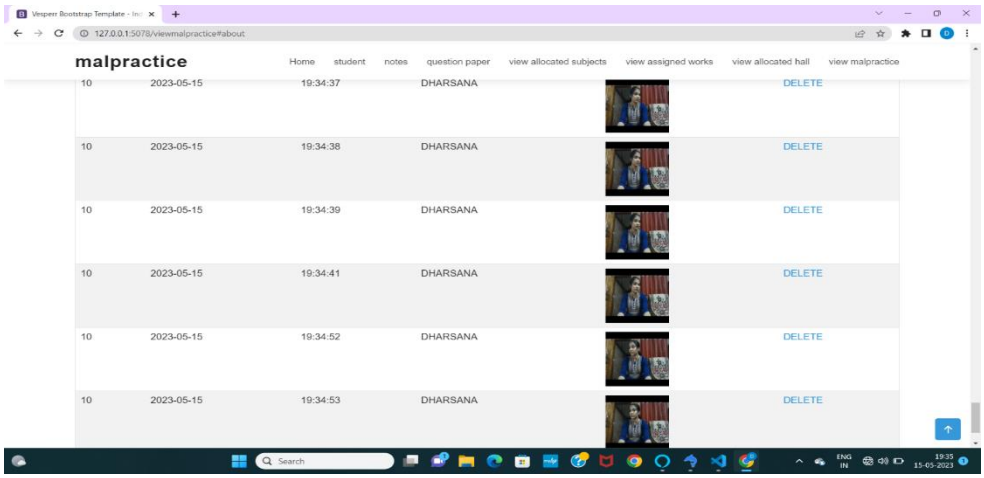

Figure 9. Malpractice Report

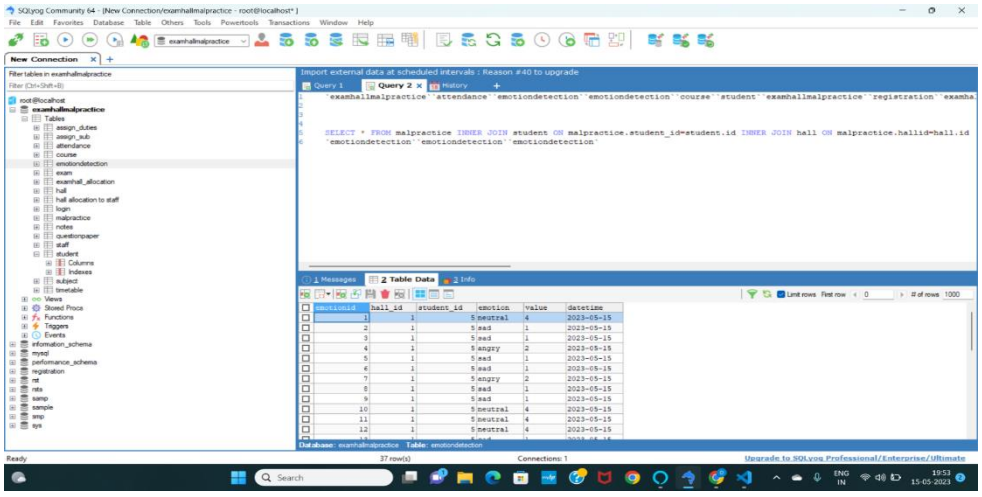

Figure 10. Emotion Analysis Report

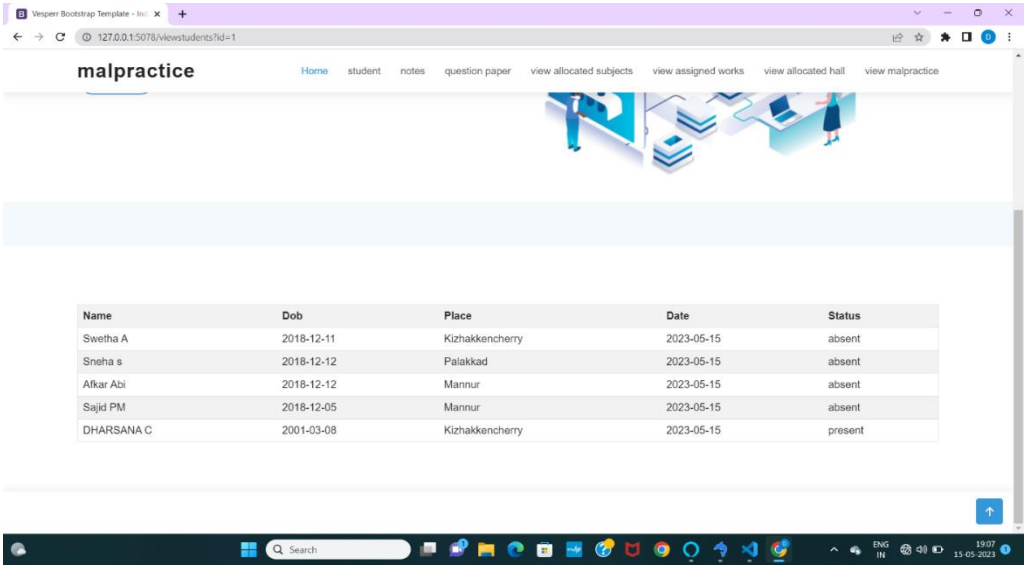

Figure 11. Attendance Report

7. Implementation

The frontend of the system is built using HTML, CSS, and JavaScript. The database used is MySQL. The Flask framework of python was used to develop the system. Keras, CV2 were some of the python libraries that is used in the system. Head movement detection is done using Computer Vision and MediaPipe. Emotion analysis and face recognition is done using Haar Cascade Frontal Algorithm.

Table 1. Existing System Limitations

SYSTEM	METHOD	LIMITATIONS
[1]	OpenCV	CCTV camera is to be placed in lateral position. Fails to detect cheating activity among multiple people in the camera feed. Front view of the person does not give desired output. Since the camera is in side, there might be difficulty in face recognition.

Table 2. Proposed Work Advantages

SYSTEM	METHOD	ADVANTAGES
Proposed Approach	Computer Vision and MediaPipe, Haar Cascade Frontal Algorithm	CCTV camera can be placed in front position. It can detect malpractices among multiple students simultaneously since the algorithm can detect multiple objects in an image. Front view of the student is taken so it is convenient for face recognition.

8. Conclusion

Cheating in exams took place even if there a significant development in the technology. There are several methods available to detect cheating during online examinations. But the offline exams are following the traditional way of invigilation which leads to errors and requirement of large amount of energy, labour and time. So, the proposed methodology aims at replacing traditional exam invigilation system with automated invigilation system using CCTV cameras, Python programming and Machine Learning. The proposed system will work with good accuracy of 97% for posture detection and 66% for emotion analysis. The proposed system will introduce a new advancement in the educational sector by automating the invigilation and exam management process.

9. Future Scope

The system can also be expanded in the future to detect cheating in exams in a more advanced way. Detection of lip movement of the students in the exam helps to identify whether the student involved in malpractice. Lip movement can be analyzed using techniques like deep neural network. Also, the tracking of eye position of the student also helps in identifying the malpractices. Eye positions can be tracked using techniques like OpenCV. The future of automated invigilation system is more promising and it will pave the way for a new advancement in educational sector.

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