Smart Examination System:
Automatic Remote Proctoring System

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Problem Definition & Motivation

MOTIVATION:- Nowadays due to the COVID Pandemic, the examinations are conducted virtually. Considering that it requires a lot of manpower. There is a dire need for a system that can check for malpractices and misconduct, while the examinations are being conducted.

PROBLEM DEFINITION-

Our Smart Examination System aims to provide a solution to the current system which is being weighed down by COVID pandemic. By providing an automatic proctoring facility in the ongoing virtual examination. We propose to develop a solution, where the user can appear for their online examination with their webcam and microphone. The system includes the components that estimate the key behavior cues like user verification, face detection , gaze estimation, voice detection, active window detection, and phone detection. If the user tries to indulge in any malpractice (eg talking to some other person, looking away from the camera), suspected cheating will be determined). Our system aims at notifying the user and the admin side if any kind of cheating takes place.

Scope

- User Verification :
  - Signup and Signin feature for Students and Admin.
  - User will be asked to upload a ID Card photograph and verify if the same person is giving the exam.
- Display tests and allow the user to attempt the eligible tests
- While the test is going on, browser will be in restricted mode and the test will be proctored using different modules and displaying logs of the same:
  - Using webcam technology, face head pose will be detected.
  - Eye movement tracking
  - Checking for multiple people in the camera frame
  - Audio detection, if the candidate is talking
  - Object tracking,for example - book, mobile phone etc
  - Detecting browser tab switching
- Admin side will be able to create exam, view different statistics:
  - Responses of the exam
  - Statistics of the number of times the student cheated
  - Add exams

Dependencies

- Working internet connection.
- Access to the internet browser
- Fully functioning webcam and microphone
- User will allow control of webcam and microphone

Software/Hardware Requirements

TYPE	MINIMUM	RECOMMENDED
Internet Connection	Wifi Connection	Wired Connection
PC Users	Windows 7	Windows 10 (10 S mode is not supported)
Mac Users	MacOS 10.13 (Oldest Still Maintained Version)	MacOS 10.15
CPU	more than 2 core CPU less than 85% CPU Usage	more than 4 core CPU less than 50% CPU Usage
Webcam	640x480 resolution	1280x720 resolution
Internet Download Speed	1 Mbps	12 Mbps

Software/Hardware Requirements

Internet Upload Speed	1 Mbps	3 Mbps
RAM	4 GB less than 95% Ram Usage	16 GB less than 70% Usage
Screen Resolution	1366 x 768	1920 x 1080 and above
Chromebook Users (Only for Automated Proctoring. Is not Supported for Live Proctoring)	Chrome devices are running the latest version of Chrome OS.	Chrome devices are running the latest version of Chrome OS.

Literature Survey

Paper	Main Idea
[1]Automated Online Exam Proctoring	It has proposed a technique in continuous user's verification on face checks by executing a gradual preparing measure utilizing pictures caught from m-learning on the online meetings as information collection to build the modules against varieties of posture and lighting. The calculation is prepared each time a client completed his talk.
[2]An Intelligent System For Online Exam Monitoring	The examinee's face is recognized and feature points are extracted to estimate a head pose . Yaw angle fluctuations, audio presence, and active window capture are used to detect misbehaviour. They tested the technology in an e-learning environment and were able to make exam monitoring simple. The face movements of a single student writing the exam are captured using a camera. This video was used as a source of data for analysis. The video input is divided into frames at a predetermined frame rate. These frames are used to extract feature points and estimate head posture. A video of a person facing away from the computer on both sides was used in the yaw angle estimate experiment. The yaw angle changes from negative to positive when the head travels left and right.
[3]Student Eye Gaze Tracking during MOOC Teaching:	This paper focuses on Massive Open Online Courses, about best practices on e-learning and active teaching, so the efficiency of student network learning is worthy of professor's attention.The methodology in brief is first locate the center of the iris by the Average Feature Point method to calculate iris deflection angle and the distance from the iris center to the eye center; and detect the face key feature points(eye,nose,mouth,etc.) by calling face key point detector in Dlib to determine the face rotation angel; then extract the student target body by Maximum Connected Domain Moment Characteristic method to calculate the student body tilt angle; last determine whether the three angles meet the giving conditions, further judge the student is watching the teaching video online or not.

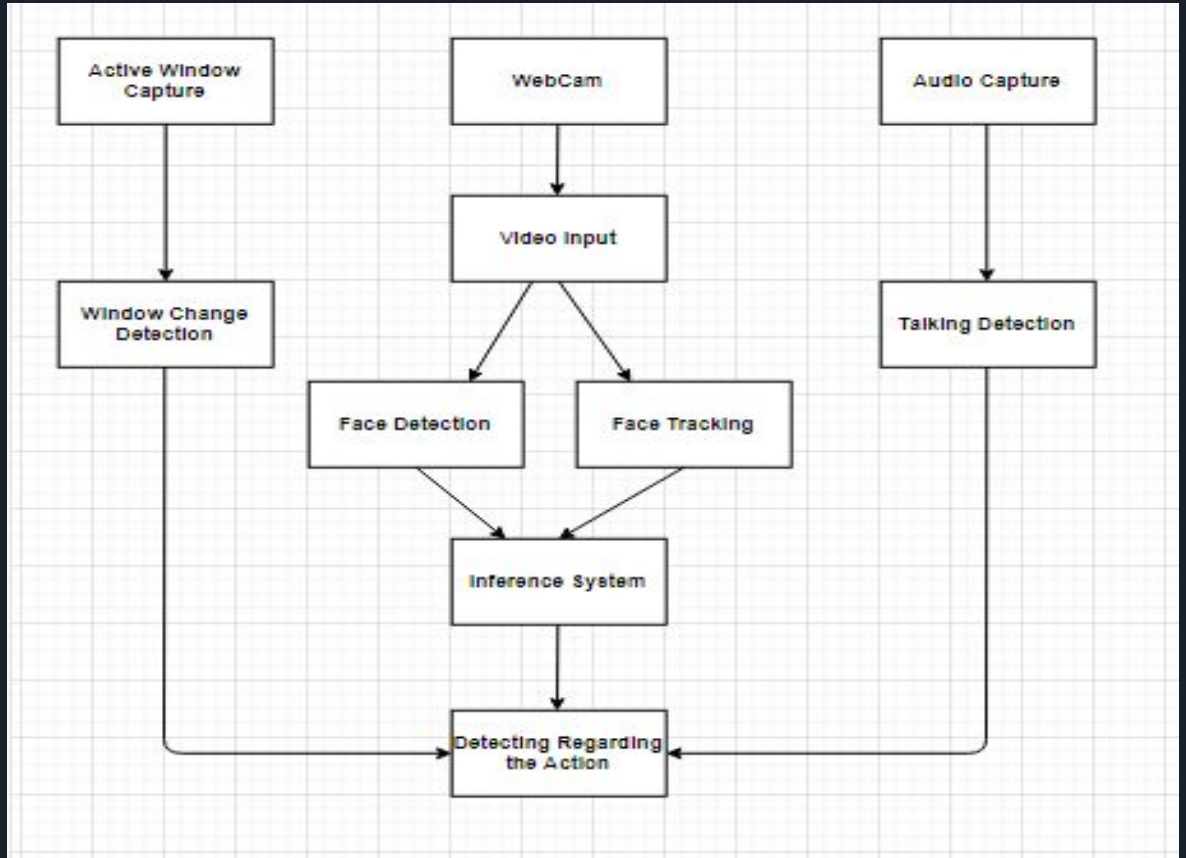
Literature Survey

Paper	Main Idea
[4]Eye Movement Classification Using CNN	The paper aims focuses on an approach that employs deep convolutional neural networks which will run for studying eye movements. The methodology in brief is to use OpenCV and dlib to extract eyes, next histogram equalization is used to boost contrast. The image of 3 Class(left, right and centre) fed to a neural network consisting of This model consists of 3 convolution stages, each stage will be followed by Rectified Linear Unit. Video is captured through webcam for testing.The accuracy in 3 class classification is 96 percent.
[8]A Visual Analytics Approach to Facilitate the Proctoring of Online Exams	This paper presents a novel visual analytics approach to facilitate the proctoring of online exams by analyzing the exam video records,head movements and mouse movement data of each student.They calculated several statistical metrics of head poses (e.g., average yaw angle, maximum pitch angle), which were further input into their regression models to predict whether a student had cheated or not in the exam.They have conducted interview with four experts and from them they have taken feedback of their system.

Literature Survey

Paper	Main Idea
[12]Automated Proctoring System using Computer Vision Techniques	This paper proposed a method using various computer vision algorithms that can monitor students.For eye gazing the model was tested on various threshold values with respect to different lighting environment. For the audio detection, they have used google speech recognition API, convert it to text assuming that If someone is trying to cheat, they will read something from the question paper. Hence, the proctor is given with a list of frequent terms and their frequency.This study demonstrates how to avoid cheating in online examinations by employing semi-automated proctoring based on vision and audio capabilities, as well as monitoring several students at onc
[6]A Design of Continuous User Verification for Online Exam Proctoring on M-Learning	The paper proposes a method in continuous user verification based on face verifications by implementing an incremental training process using images captured from mobile learning online lecture sessions as training data set in order to increase the robustness against variations of pose and lighting. The continuous face detection and verification process will be done by applying a CNN method by using the weight resulted from the incremental training when the user took the online exam on his mobile device.

System Architecture



Proposed System

We aim to develop a multimedia system that aims to restrict the malpractice while the examinations are going on along with delineated statistics:

(1) The users appearing for the examination on our portal, will be required to keep their audio and video on throughout the examination. to determine if they are using unfair means.

(2) User Verification: This module will verify, if the person appearing for the exam is the said student or not. It uses ID card issued by the university as an input.

(3) Face Detection: There are various factors to affecting while detecting face such as:
   (a) Different angles of the face
   (b) Head moving
   (c) Occlusion of face
   (d) Different lighting conditions
   (e) Frame rate achieved

Out of various face detection models like Haar, MTCNN, DNN etc. We will select a model which covers most scenarios while balancing performance.

(4) Eye Gazing: The eye gazing module takes the features of iris and eye corner points into account and locate where the user is looking. Thus help us to curb cheating.

(5) Audio Detection: Seeking verbal help form another person in same or over a phone call, is common way of cheating . So using the classification model, the sound captured will help determine if the the student is cheating.

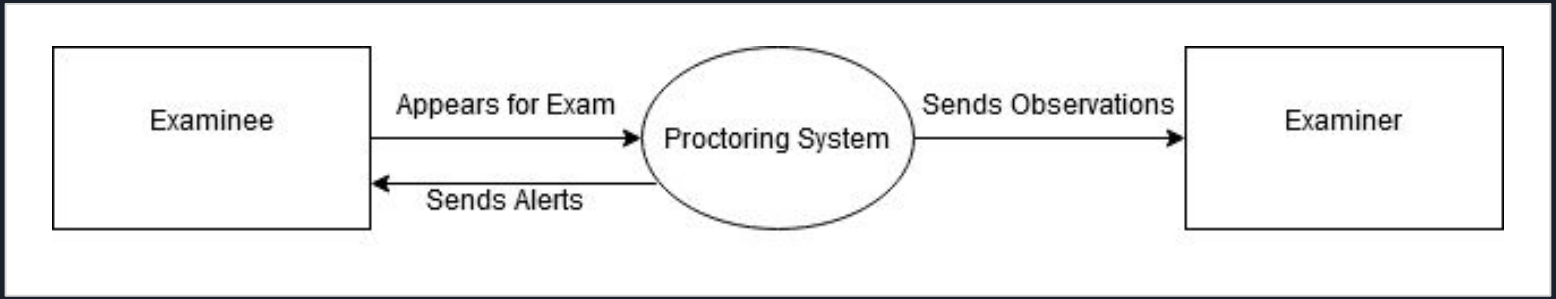
(6)Mouth Detection: We use it to check if the candidate opens his/her mouth during the exam after recording it . We use it to detect if the student attempts to speak anything.

(7)Window Detection: Determine window/tab change while the exam is going on.

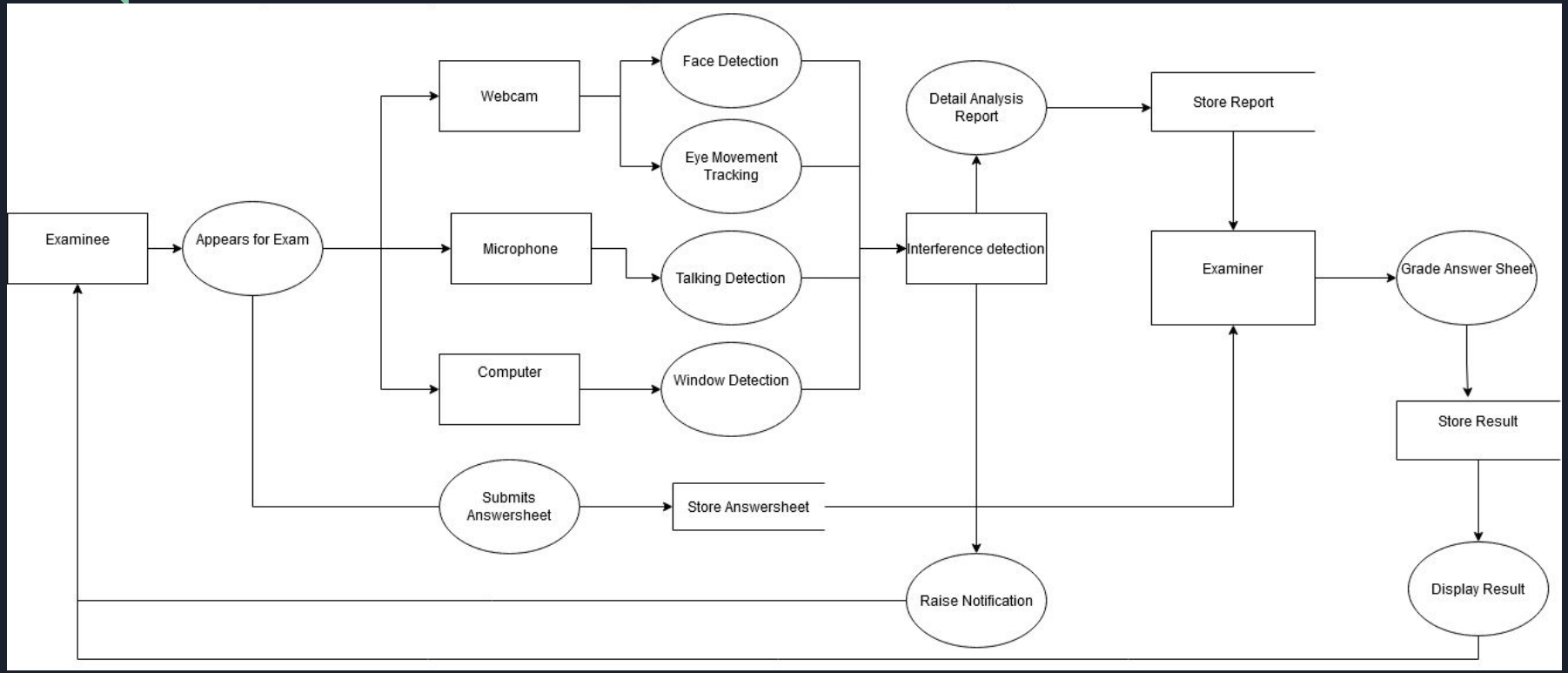
(8) To check if any other person comes in front of the window frame and Object tracking - Using Tensorflow and library YOLO it will be easier to determine if there is any extra object in the frame

(9) Display detailed statistics of every student.

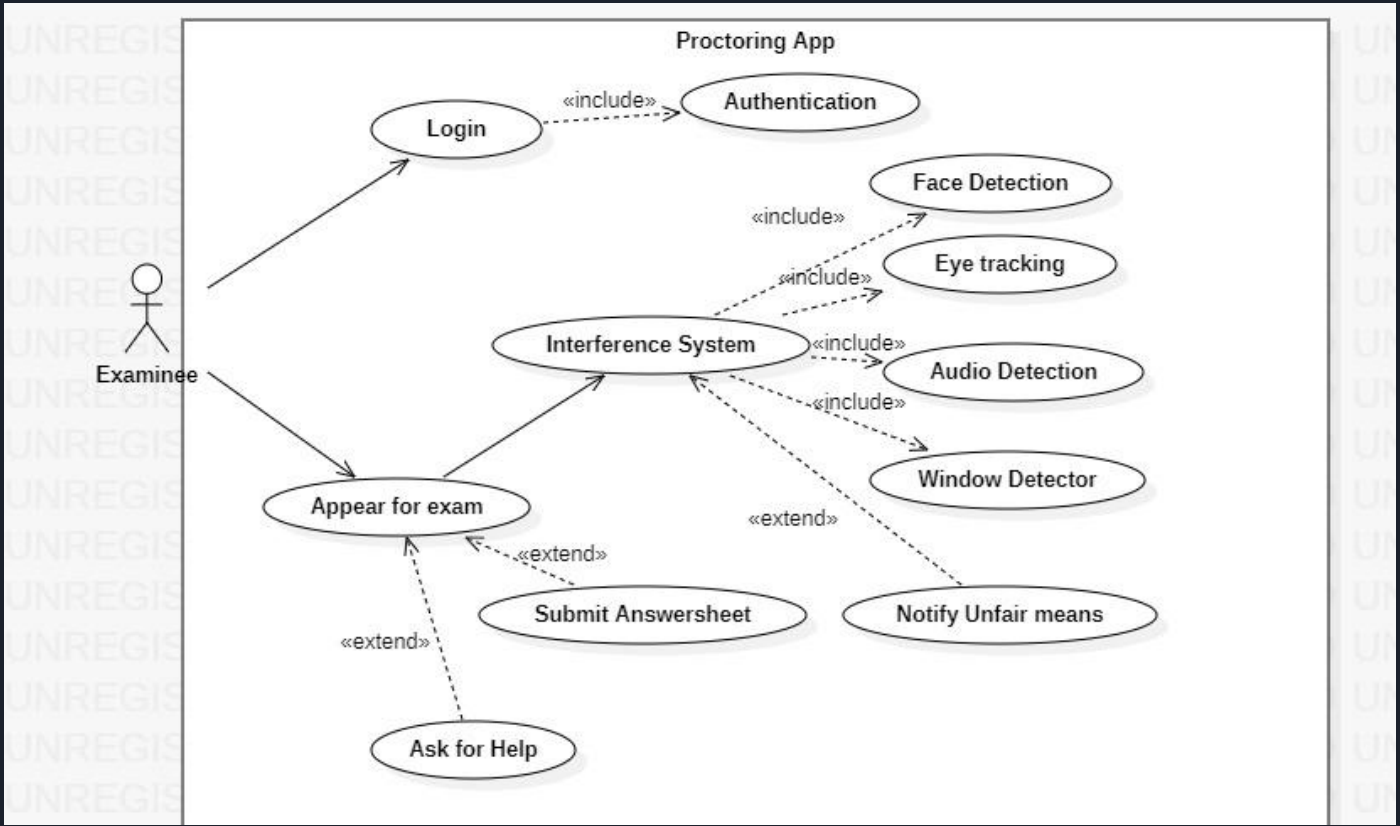
System Design- Data Flow Diagram



System Design- Data Flow Diagram



Use Case Diagram



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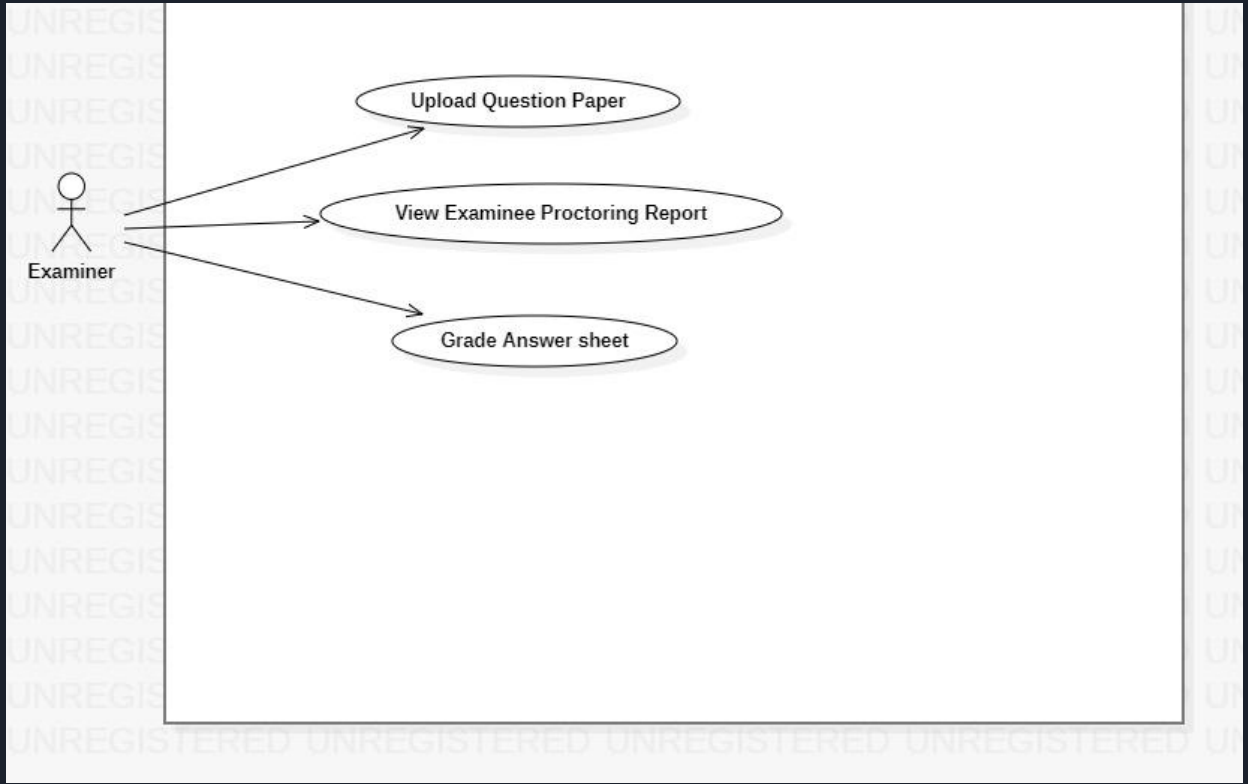

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