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Classroom Monitoring System by Wired Webcams and Attendance Management System

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ABSTRACT: A system is developed from the monitoring and attendance point of view. The objective of the proposed system is to develop a system that monitors the area in which it is being deployed. The stored videos will then be useful to analyze and trace the activities in that particular area. Along with monitoring the attendance is automatically marked. It also recognizes fraudulent students and provision to maintain a separate record of the fraudulent students. The attendance will be marked by taking the data from the video captured; the attendance will be marked on an individual level as well as overall and another feature of alarm or sound is introduced. It is used in various applications such as educational institutes, bank, health care centers, residential etc. This system will have a large market as well as its efficiency and features will attract many customers. This system is to reduce human efforts, time and workload.

KEYWORDS: Image processing, Viola-Jones, PCA, Eigen vectors.

I. INTRODUCTION

Domain Introduction: Image processing is a method for converting an image into digital form and for performing some operations on it, in order to get proper image or to retrieve some useful information from it.

Today, automatic recognition of human faces is a field that gathers many researchers from different disciplines such as image processing, pattern recognition, computer vision, graphics etc. Face detection and tracking in video actually began as an independent topic itself because of the requirement of face recognition. Generally, there are three main processes for face detection based on video. At first, it begins with frame based detection. During this process, lots of traditional methods for still images can be introduced such as statistical modelling method, neural network-based method, BOOST method colour-based face detection etc. However, ignoring the temporal information provided by the video sequence is the main drawback of this approach. Secondly, integrating detection and tracking, is detecting face in the first frame and then tracking it through the whole sequence. Since detection and tracking are independent and information from one source is just in use at one time, loss of information is unavoidable. Finally, instead of detecting each frame, temporal approach exploits temporal relationships between the frames to detect multiple human faces in a video sequence. In general, such method consists of two phases, namely detection and prediction by update – tracking. In previous research, Viola-Jones detector publication several researches on face detection, tracking and recognition has been established. This system uses Viola-Jones for face detection since this method is robust, accurate, tolerant to light, background colour and is 15 times faster than the other algorithms. This method proved to detect objects extremely rapidly and is comparable to the best real time face detection systems. Viola and Jones used features extracted from the training set and AdaBoost algorithm to select the best feature set and constructing the final classifier which comprises few stages.

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II. RELATED WORK

A. *Image Processing:*

Image processing is a type of signal exemption in which input is image, like video frame or photograph and output may be image or characteristics associated with that image. Usually Image Processing system contains treating images as two dimensional signals while applying already set signal processing methods to them. It is among vastly growing technology today, with its applications in various aspects of business intelligence. Image Processing forms basic research area in engineering and computer science disciplines too. Image processing basically contains the following three steps: Importing the image with optical scanner or by digital photography. Analysing and manipulating the image which includes data compression and image enhancement and spotting patterns that are not to human eyes like satellite photographs. Output is the last stage in which result can be altered image or report that is based on image analysis.

B. *Security:*

Sensor networks are expected to play an important role in the upcoming age of prevalent computing. Due to the constraints of prevalent computing in computation, memory management, and power resources, their susceptibility to physical capture, and wireless communications use, security is a challenge in these networks so wired networks has been developed. The scale of deployments of wireless sensor networks needs careful decisions and trade-offs among various security measures. Mechanisms to get secure communication in these networks are considered. Widely spread deployment of sensor networks is on the horizon. Given their versatility property, sensor networks will soon play an important role in critical military applications as well as pervade our daily life.

III. PROPOSED ALGORITHM

A. *Face Detection:*

Face detection techniques have been analysed for years and much growth has been developed in literature. Most of the face detection methods focus on detecting frontal faces with good lighting conditions. These methods can be classified into four types: knowledge-based, feature invariant, template matching and appearance-based.

- Knowledge-based methods are using human coded rules to model facial features, such as two symmetric eyes, a nose in the middle and a mouth underneath the nose.
- Feature invariant method is used try to find facial features which are invariant to pose, lighting condition or rotation. Skin colors, edges and shapes fall into this category.
- Template matching method is to calculate the correlation between a test image and pre-selected facial templates.
- Appearance-based method is to adopt machine learning techniques to extract discriminative features from a pre-labeled training set.

An approach used to detect objects in general, applicable to human faces as well was presented by Viola-Jones. Viola and Jones (2004) presented in their research a new image representation called Integral Image which allows fast calculation of image features to be used by their detection algorithm. The second step is an algorithm based on AdaBoost which is trained against the relevant object class to select a minimal set of features to represent the object. Each stage of Viola and Jones consists of few simple weak classifiers that work together to form a stronger classifier filtering out the majority of false detections at early stages and producing an adequate final face detector. Viola and Jones presented a fast and robust method for face detection which is 15 times quicker than any technique at the time of release with 95% accuracy at around 17 fps. This work has three key contributions: "Haar-Like" feature representation. It introduced a new, efficient, method for features calculation, based on an "Integral image". It introduced a method for aggressive features selection, based on AdaBoost learning algorithm. Also it includes following three steps:

Step 1: Haar Cascade Classifier:

The main basic idea for Haar classifier object detection is the Haar-like features and by using this, features can be extracted. These features, rather than using the intensity values of a pixel, use the change in contrast values between adjacent rectangular groups of pixels. The contrast variances between the pixel groups are used to determine relative

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light and dark areas. Two or three adjacent groups with a relative contrast variance form a Haar-like feature. The Haar-like feature, as shown in Fig.1 is used to detect an image.

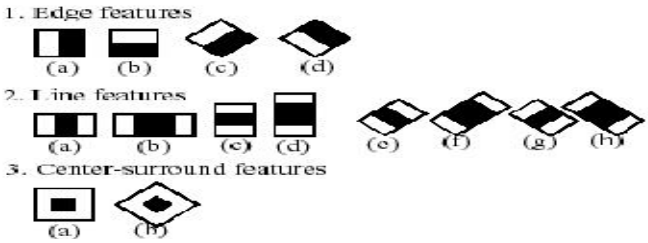

Fig.1. Haar-like Feature

Step 2: Haar Integral Image**:**

A representation that means any rectangle's values can be calculated in four accesses of the integral image. The integral image is an array containing the sums of the pixels' intensity values located directly to the left of a pixel and directly above the pixel at location (x, y) inclusive. Using the appropriate integral image and taking the difference between six to eight array elements forming two or three connected rectangles, a feature of any scale can be computed. Thus calculating a feature is extremely fast and more efficiently used. It also means calculating features of various sizes requires the same effort as a feature of only two or three pixels.

Step 3: Classifiers-Cascaded:

For Classifiers cascaded the AdaBoost learning algorithm is used. In AdaBoost algorithm, although calculating a feature is extremely efficient and fast, calculating all 180,000 features contained within a 24 × 24 sub-image is impractical [Viola 2001, Wilson 2005]. Fortunately, only a tiny fraction of those features are needed to determine if a sub-image potentially contains the desired object. In order to eliminate as many sub-images as possible, only a few of the features that define an object are used when analysing sub-images. The goal is to eliminate a substantial amount, around 50%, of the sub-images that do not contain the object.

B. *Face Recognition:*

Several algorithms are used for face recognition. Face recognition by feature matching is one such method .We has to locate points in the face image with high information content. We don't have to consider the face contour or the hair. We have to concentrate on the centre of the face area, as most stable and informative features are found there. The high informative points in the face are considered around eyes, nose and mouth. The simplest template-matching approaches represent a whole face using a single template, i.e., a 2-D array of intensity, which is usually an edge map of the original face image. In a more complex way of template-matching, multiple templates may be used for each face to account for recognition from different viewpoints. Another important variation is to employ a set of smaller facial feature templates that correspond to eyes, nose, and mouth, for a single viewpoint. The most attractive advantage of template-matching is the simplicity; however, it suffers from large memory requirement and inefficient matching. However, perfect extraction of features is shown to be difficult in implementation. A dataset, such as a digital image, consists of a large number of inter-related variables. Using Principal Component Analysis, the dimensionality of the dataset is reduced while retaining as much as variation in the dataset as possible. The datasets are transformed to a new collection of non-connected variables called the principal components. These principal components are ordered in such a way that the first few retain most of the variation present in all of the original variables. PCA method is applied in face recognition by discriminating the image data into several classes. There will be a lot of noise in the image caused by differing lighting conditions, pose and so on. Beside these noises, there are patterns that can be observed in the image such as the presence of eyes, mouth or nose in a face and the relative distances between these objects. PCA's objective is to retrieve these patterns or the features from the given image.

The idea of appearance-based approaches is to project face images onto a linear subspace of low dimensions. Such a subspace is first constructed by principal component analysis on a set of training images, with Eigen faces as its Eigen vectors. Later, the concepts of Eigen faces were extended to Eigen features, such as Eigen eyes, Eigen mouth, etc. for

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the detection of facial features. Principal component analysis is a mathematical procedure that uses orthogonal co-ordinates for converting a collection of observations of possibly connected variables into a collection of values of non-connected variables called principal components. PCA is then applied on the Eigen faces. This is the main module of the face authentication based attendance system. The task of this module is to recognize the student from his/her face image. It requires some pre-defined training data to compare the features. This training database is saved to the server and the system has to access it. Training data is obtained by adding the Features of face images of the students in the class. The training data is saved in an .xml file which can be updated when a new student is registered for that class. The Principal Components Analysis (PCA) is the eigenvector-based techniques we used for dimensionality reduction and feature extraction in automatic face recognition.

IV. SYSTEM MODULES AND IMPLEMENTATION

Problem Statement: To develop an Automatic classroom monitoring system through wired webcams for attendance. The system consists of following six modules:

Module 1: Webcam Deployment:

The wired webcam is deployed with the interface for capturing live videos. The data that will be transferred through packets to the database.

Module 2: Capture and store in database:

The camera used for monitoring will capture the videos and transfer the data to the database. While the camera used for identifying individual student will recognize every student through face recognition and compare the newly received data with already stored data in the database for marking attendance of each student.

Module 3: Security:

In the proposed system we will provide security at user level. The various users (in our case HOD, Class Teacher, other professors) will be given privilege levels to control access to our system.

Module 4: Application – Attendance:

An added feature to our system is attendance management. The camera that is used for monitoring will maintain a record for head count using which a report will be generated and sent to the authorities in case of mass bunk or weak attendance.

Module 5: Functioning/Working:

A message will be sent to all the students at the same time a mail will also be sent to the authorities. This will help authorities to get a report/monitor a particular class/area in which the camera is deployed.

Module 6: Report Generation:

A report will be generated on daily basis for each student with the help of the acquired data in the database (for each student). Similarly a report regarding attendance of whole class using head count will also be generated. This will benefit the user to gain a review of the attendance of an individual, identifying the defaulters easily as well as obtain a report of the class as a whole.

V. RESULTS AND DISCUSSION

The login form allows user privilege. It allows two users to access the feature of the developed project. HOD or admin are allowed to handle. It consists of two tabs; Login and password as shown in Fig.1 and Fig.2 which are unique for each user and also in Fig.3 and Fig.4. After login by the particular authority the welcome email and notification is sent that particular authority. After login one form is get opened i.e. in Fig.5 and Fig.7 which consist of tabs like face Authentication system, view attendance report as in Fig.9, exit, start/stop as in Fig.6 and Fig.8 and snapshot button as in Fig.10. Further after clicking on face authentication system tab the new form is get opened and which further consist of the tabs like add new student in Fig.14, capture in Fig.15, train database in Fig.16, exit button. The functionality of face authentication tab is to add new student in the database or create database in Fig.11 and authenticate it after further

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if that student encounters. The capture button is used to capture the images of new student to add in a database. Train database tab is used to train that newly captured student data with present database. Exit button is used to exit from the face authentication tab. View attendance tab in Fig.9 is used to view the recorded attendance. It is used by the authorities to view the attendance of the present student. Start/stop button is used to start the video capturing and same will be used to stop the video capturing. The email is sent to the student when the attendance of a student is get marked. If fraudulent student is found then record of that student is also maintained as invalid i.e. Fig.12. And the snapshot of fraudulent student is sent to the HOD that the unauthorized attempt is get accessed. After the start of lecture the overall attendance of a student is get counted and if it is less than threshold then the email is sent to the all student that lecture is get started in Fig.18 and come in the classroom within 10 minutes. If the attendance of student is get marked then the email notification is sent to the individual student that your attendance is get marked as shown in Fig.17. After clicking some span of a time the lecture wise attendance of a student report is sent the respective authorities as in Fig.18.

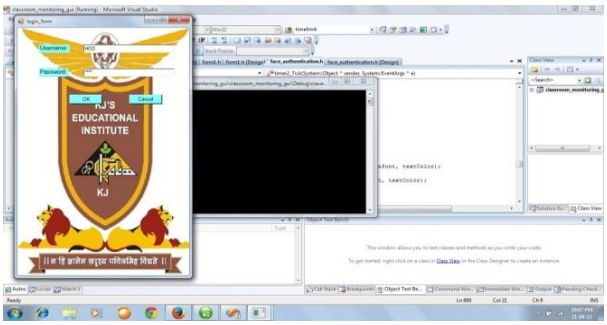

Fig.1. Login(HOD)

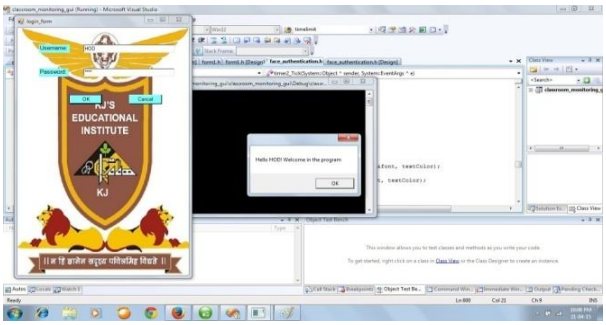

Fig.2. Authentication

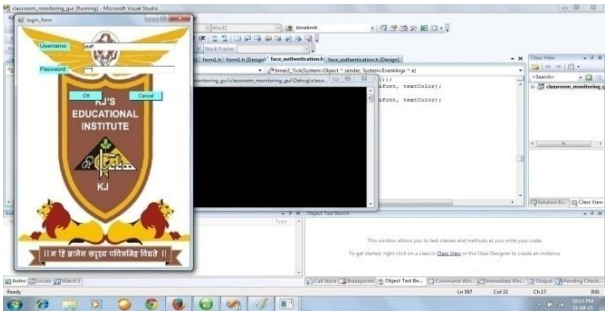

Fig.3.Login(Staff)

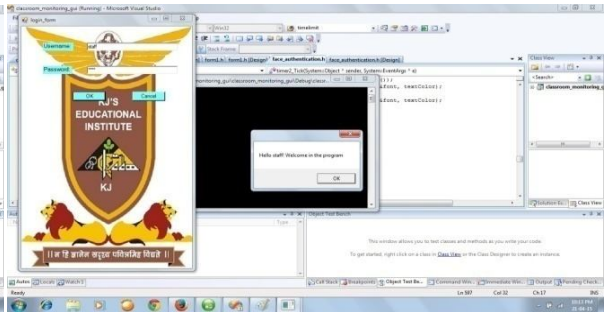

Fig.4. Authentication

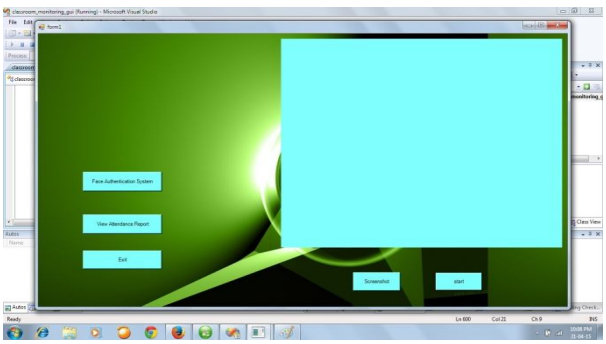

Fig.5. Main Form (HOD)

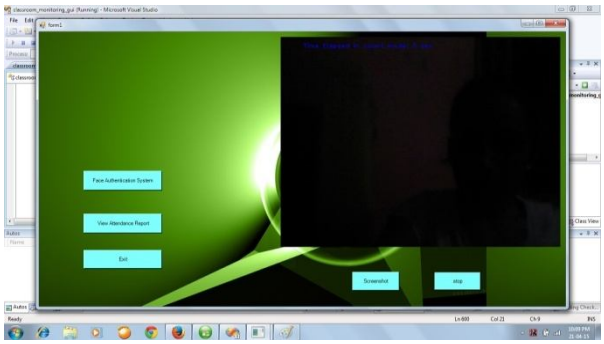

Fig.6. Monitoring/Video Capture

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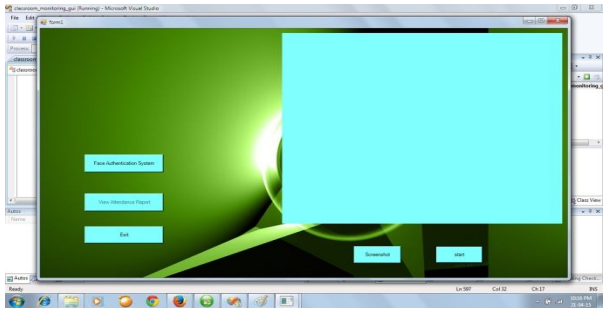

Fig.7. Main Form (Staff)

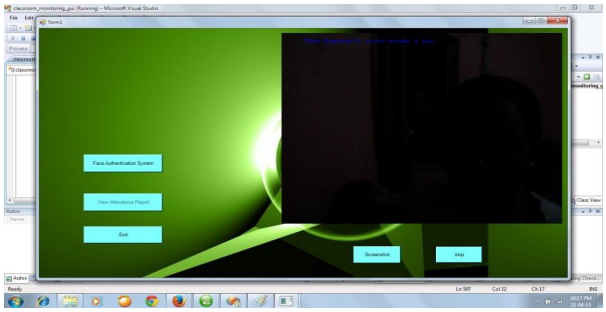

Fig.8. Head Counts

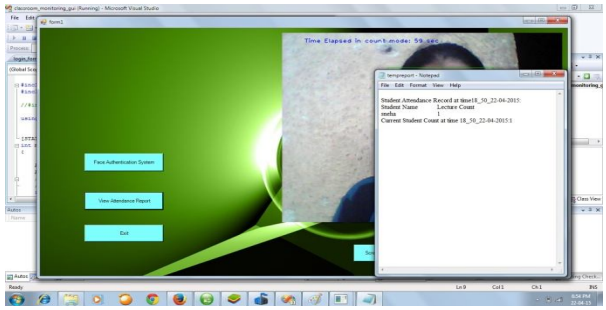

Fig.9. View Attendance Report

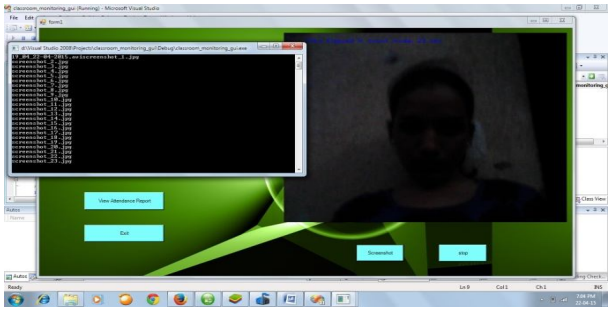

Fig.10. Screenshot

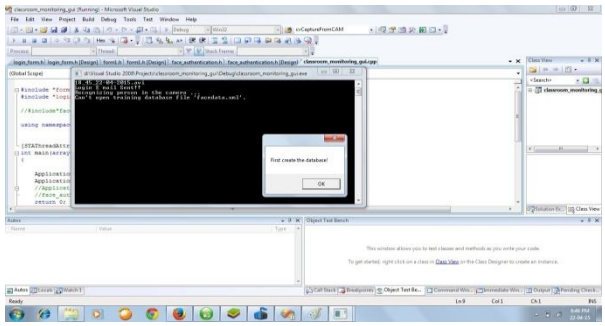

Fig.11. Create Database

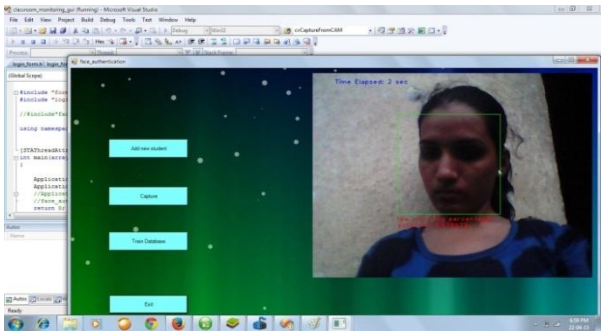

Fig.12. Invalid

Fig.13. Face Authentication

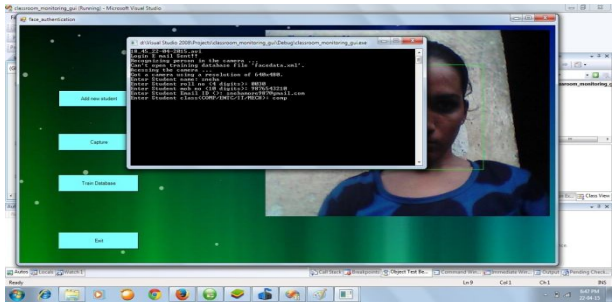

Fig.14. Add New Student

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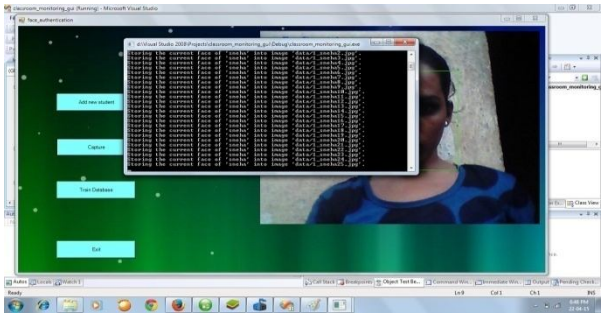

Fig.15. Capture

Fig.16. Train Database

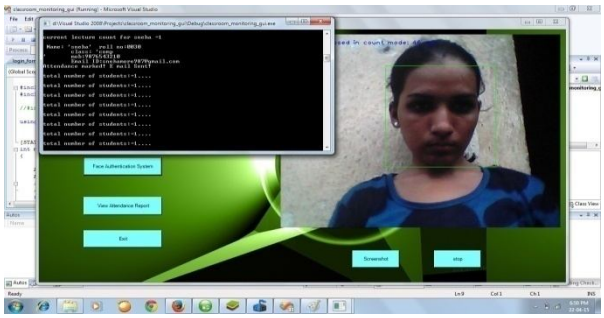

Fig.17. Attendance Marked

Fig.18. Head Count/ Report

VI. CONCLUSION AND FUTURE SCOPE

The proposed system aims for effective reduction of human errors and efforts. In existing attendance system like RFID, thumb impression or finger print technology, the new technology has been introduced. The system is primarily used for monitoring a particular area and automatically marking the attendance, it reduces the drawbacks of traditional attendance system which is proxy attendance, wastage of class hours etc, it will successfully mark the attendance of individual student and overall class benefit to know and report a mass bunk in case of low overall attendance. The updated attendance can be viewed by the authorities without any dependencies.

In future we can linked this module with website or any database server so that's why user or candidate can update their attendance itself and the attendance can viewed by chairman/secretary/user through the online at any time without having dependency on another person or others data. And it also reduces individual time. The advantage is Reduction of time complexity by using ROI.

VII. ACKNOWLEDGEMENT

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