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Automated Attendance System using RFID and Face Recognition

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ABSTRACT: Regularity of student's attendance is prior in the administration of all the Educational Institutions during the recent decades. Poor attendance leads todetention which affects the overall academic performance of the students. Even in this hi-tech century, student's attendances are marked on attendance sheet delivered by the faculty members in the classroom, which leads to consumption of time and the process is also completely manual. Although RFID based and face recognition based implementation have been proposed, but they are separately implemented. The proposed system for student's attendance system includes a RFID reader combined with Face recognition system. RFID readers would be installed at different locations in campus and also in classes alongside cameras for face recognition. When student enters the campus, reader send that location to the server and the student is tracked easily. Server checks the timetable of that student if he/ she is unable to attend lecture according to timetable then notification will be directed to the admin. This system guarantees that attendance record of the students would be preservedappropriately and efficiently. The system will accordingly generate detention list of the students. It is minor scale automated application, which is easy to govern as well as time redeemable and trustworthy.

KEYWORDS: Automated Attendance System, Drift Removal (DR), Indoor Positioning, Radio Frequency Identification (RFID), Face Recognition, Kalman Filtering DR

I. INTRODUCTION

Attendance of each and every student is being maintained by every school, colleges and university. Faculty has to maintain relevant and proper record for the attendance. The manual attendance record system is not efficient as it consumes a lot of time to arrange record and to calculate the average attendance of each student. Hence there is a need of a system that will resolve the issue of student record arrangement and student average attendance calculation. The proposed system should be able to store the student's attendance record in digital format so that managing attendance becomes simple task.

Old traditional methods for student attendance are still in use by most of the universities and institutes. As these techniques are used, many students gets an advantage to mark the attendance of their classmates in their absence. So while these methods are used, attendance records are classified and maintained manually by the faculty to know the student attendance list. The faculty needs to take the attendance once again in case of the loss in attendance sheet and therefore absent students gets an opportunity to mark their fake presence in new attendance sheet.

This procedure, besides being tiresome for lecturer, it even affects student as lot of time is consumed on signing, verifying and then submitting the attendance sheet. Therefore, an automated computerized system can be implemented that would achieve and help the staff members to maintain and mark the attendance easily. The faculty can easily access this system as it is simple. Handling and managing of student attendance data needs to be taken care by the system so that the manual work of student attendance can be avoided. The system would automatically consider all the data once it gets updated.

A. Why RFID?

In 1940s RFID was developedby Charles Walton. For the yearsfollowing this invention scientist and scholars think aboutthe possibilities of using this technology. RFID is a combination of radar and radio broadcast technology. However, global positioning system (GPS), the most widespreadoutdoor positioning system, nowadays, is poor and inappropriate for indoor positioning applications due to its line-of-sight nature. In the past years, several research

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activities and profitable solutions to radio indoor positioning systems for complementation of GPS have been developing. Among varied radio indoor positioning systems, active radio frequency identification (RFID) is more encouraging than infrared, ultrasonic, and Wi-Fi. As infrared indoor positioning system has restrictions of line-of-sight inherence and short detection range, as then RFID indoor positioning system does not. Ultrasonic indoor positioning system takes more costly infrastructure and deployment cost than RFID indoor positioning system. Wi-Fi indoor positioning system also exhaustsmore power dissipation and deployment cost in brand new buildings or factories than RFID indoor positioning system. Because the above-mentioned radio indoor positioning systems are essentially originated from wireless sensor networking (WSN) technology, their localization granularity and precision are similar so that performance comparison on them is unnecessarily addressed. However, all of the following future techniques for RFID indoor positioning system in this paper can also be applicable to the other kinds of radio indoor positioning systems. In addition, NFC and passive RFID technologies cannot be taken into thought, because the very short detection range of NFC and passive RFID, mostly within 10 cm, evades themselves from performing trilateration or multilateration for location estimation (LE) of the radio indoor positioning system.

B. Why Face Recognition?

Nowadays,unique person identification is one of the most important building blocks for the attendance system. If we implement only RFID based attendance system, then there can be many possibilities of false entries i.e. proxies may increase. In traditional attendance system one can easily make his or her friends attendance by marking his sign in his absence. Infact in RFID based attendance system one can easily enter others attendance in his or her absence by using his or her tag.

Biometric-based techniques shows to be more auspicious techniques for identifying an individual, instead ofauthenticating people and providing them access to physical and virtual domains based on passwords, PINs, smart cards, tokens, keys and so forth. These methods inspect an individual's behavioral and physical characteristics in order to determine his or her unique identity. But the passwords and PINs are difficult to recall and can be predicted easily or stolen.

So here person identification plays an important role. Amongst the person recognition methods, face recognition is known to be the most familiar ones, as the face modality is a method that uses to identify people in everyday lives. Although other approaches, such as fingerprint identification, can offer improved performance, still those are not suitable for natural smart interactions due to their extended nature. In contrast, face recognition provides passive explanation that is the person to be identified does not need to liaise or take any specific action. Means it does not need to interface with the reader directly, it will be donerobotically.

II. RELATED WORK

A. Conventional Attendance System

In a large portion of the colleges or schools the participation is kept up utilizing the participation sheets. The understudies sign on their individual move numbers and the participation is checked. This participation is further set apart into registers by the separate resources. The fundamental issue in this strategy is that this procedure devours substantially more time and makes interruption in the progressing address. Additionally the odds of the false sections mean the intermediaries increments. Understudies might make their companion signature while denoting their own particular participation. So it decreases the productivity. It additionally upgrades the endeavours of resources to check that participation again in registers from participation sheets.

B. RFID Based Attendance System

The other for the most part utilized participation framework is RFID based participation framework. This framework is for the most part utilized as a part of organizations to keep up the worker's participation. For the most part in this framework the detached sort RFID is utilized. At the point when one needs to check his participation, he holds his tag close to the peruser. When it comes in peruser's region then the tag gets actuated by the transmitted waves from peruser and retransmits the data put away in it. In any case, the issue with this framework is that the latent RFID has short range. So you need to fare thee well that your tag punched effectively. It will be wasteful for a few times. Because of short range (10-15 cm) the aloof RFID labels can't be utilized for area estimation.

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C. Biometric Attendance System

1) Fingerprints:

Fingerprints are the investigation of distinguishing people by their physical attributes. It is the most broadly utilized prudent client verification system which manages human finger impressions. It is for the most part found in regions, for example, government areas, instructive foundations, mechanical fields, and so on. The finger impressions are caught by the grinding edges of human fingers when human communicates with unique mark acknowledgment framework.

a) Advantages:

- It has very high precision.
- It is globally used biometric user authentication application.
- It is very easy to use.
- To store the finger templates within the system, a less amount of storage space is required.

b) Disadvantages:

- It is intrusive.
- It can make mistakes with the dryness or irregularity of the finger's skin due to varying age (especially in children).
- This system sometimes requires not just the fingerprint of user but also a valid pin, which proves to be more difficult to use than traditional systems.

2)Face Recognition:

Face acknowledgment is the exploration of recognizing people by their behavioral qualities. The most renowned illustration of a face acknowledgment exhibited by "Kohonen" is that a basic neural net could perform confront acknowledgment for adjusted and standardized face pictures. The kind of system he involved figured a face depiction by approximating the eigenvectors of the face picture's autocorrelation framework; these eigenvectors are currently known as 'eigenfaces'. There are numerous current frameworks to distinguish confronts and remember them. In any case, the frameworks are not all that productive to have computerized face discovery, distinguishing proof and acknowledgment. As picture is a mind boggling high measurement (3D) grid and handling network operation is one moment and up to check. Henceforth, this guides us to handle with huge picture database and spotlight on the new calculations which are all the more constant and more dynamic with greatest enthusiasm of exactness which are further talked about in our proposed frameworks. In our current frameworks, face acknowledgment is done on the premise of still picture i.e. Frontal face catching. Generally, face recognition for such still images can be categorized into three main groups as follows:

- Holistic Approach: In this, the whole face part is taken as an information in face location framework to perform face acknowledgment
- Feature-based Approach: In this, local features on face like nose, eyes and lip corners are portioned and then given to face detection system to easier the task of face recognition.
- Hybrid Approach: In this methodology both neighborhood highlights and the entire face is utilized as an info to face discovery framework.

The basic overall face recognition model looks like the one below:

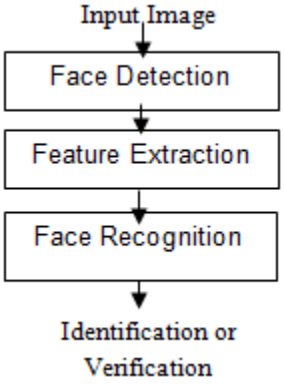

Fig. 1: Basic Block Flow Diagram of Face Recognition

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III. PROPOSED SYSTEM

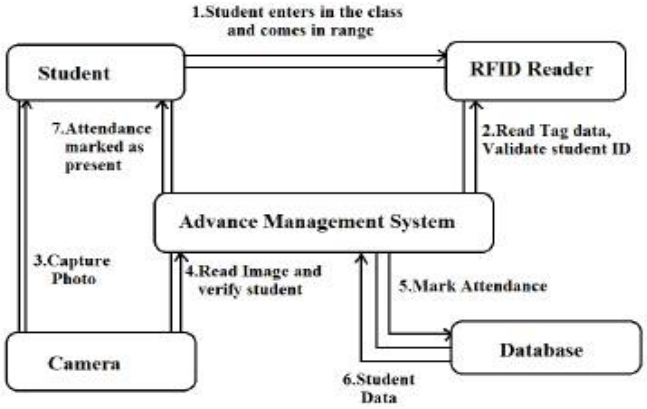

Fig. 2: Notion of Proposed system

Traditionally we used to check the participation of workers, understudies by utilizing RFID labels, for abnormal state security verification and participation reason particularly in Scientific Laboratories, Bureau Investigation Departments, and in numerous other advanced fields Face acknowledgment is utilized. Be that as it may, when we considered executing computerized participation framework for instructive reason we proposed the thought of coordinating these two innovations named RFID and Face Recognition in our school. Fundamentally RFID will be utilized to limit understudies inside of school premises furthermore will be utilized as a key while stamping participation of individual understudies where as a team with RFID, Face acknowledgment will be utilized for verification reason lastly to mark participation. RFID and FR will be clarified in further areas in point of interest as for our Project

The fundamental thought of proposed framework as appeared in Fig.2 is a standard application outline to mechanize and improve the manual push to record and report progressively, the Time and Attendance Scheme in colleges. A Log is saved in the Database. Log involves RFID Tag Id and Captured Image by means of Camera. In the event that together Student Id brought from RFID Tag and Captured Image is facilitated, vicinity is set apart as "Present" else it is set apart as "Absent".

A. RFID

RFID is the innovation used to exchange information with the utilization of electromagnetic fields and with the end goal of identifying and stalking the labels focused on the articles. Electronic data is put away in the labels. A portion of the labels are automated through electromagnetic incitement from the attractive field gathered close to the peruser. A few sorts assemble vitality from the analysed radio waves and go about as a uninvolved transponder.

The proposed framework have made utilization of aloof labels. There are three sorts of latent labels – 1) low frequency (LF) having range up to 3 feet, 2) high frequency(HF) having range around 5-10 feet, 3) Ultra-High frequency(UHF) having range around 15-20 feet. As we are adding to a little scale demo model, so we made utilization of detached labels yet when we execute the constant framework, we can utilize Ultra-High Frequency labels and execution can be further enhanced by utilizing Ultra-High recurrence perusers.

B. Face Recognition

Face recognition is a standout amongst the most tricky issues in the picture handling because of varieties in size of the picture, introduction, area, outward appearance, posture (frontal, side-view), impediment and lighting condition present which might adjust the complete appearance of countenances in the picture. In our proposed framework we are using two strategies commonly to mutually perceive the face.These techniques are as follows:

- Haar's Classifier
- Eigen Face Identifier

1) Haar's Classifier:

A procedure was planned by Paul Viola to precisely and rapidly perceive the countenances inside of a picture. By decentralizing the location zone false positive pictures are eliminated and the rate for ID is enhanced because of

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debasement of the zone analyzed. This trademark is a machine learning strategy and as opposed to utilizing concentrated estimations of pixels, it utilizes adjustment as a part of complexity qualities among nearby rectangular gatherings of pixels. It is later utilized for distinguishing the items as a part of different pictures. Haar classifiers can be easily scaled by expanding or diminishing measurement of pixel gathering that is being watched. For the most part, the calculation needs a considerable measure of positive pictures (face pictures) and negative pictures (without face pictures) to teach the classifier. At that point we should separate elements from it.

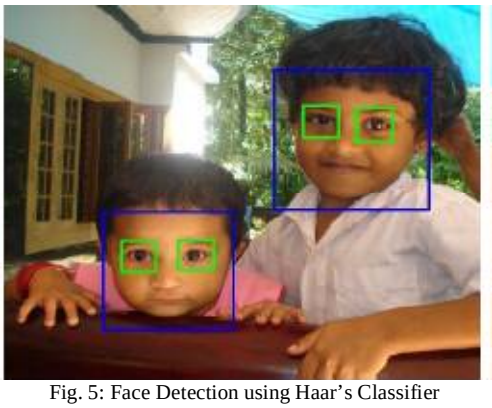

Fig. 5: Face Detection using Haar's Classifier

For this, we utilize all the perspective on every single preparing pictures. For each and every component, it finds the ideal edge which will look at the appearances to positive and negative. Be that as it may, certainly, there will be a few imperfections or misclassifications. We select the finest components with scarcest mistake rate, which implies highlights that best characterizes the face and non-face pictures.

2) Eigen Face Identifier:
Eigenfaces are an arrangement of eigenvectors utilized as a part of the PC vision issue of human face acknowledgment. The methodology of utilizing eigenfaces for acknowledgment was created by Sirovich and Kirby (1987) and utilized by Matthew Turk and Alex Pentland in face order. It is viewed as the principal fruitful case of facial acknowledgment innovation. These eigenvectors are gotten from the covariance network of the likelihood circulation of the high-dimensional vector space of conceivable countenances of people.Eigen Face Generation:

A. Eigen Face Generation:
An arrangement of eigenfacescan be produced by performing a scientific procedure called primary part investigation (PCA) on an expansive arrangement of pictures portraying distinctive human countenances. Casually, eigenfacescan be viewed as an arrangement of "standardized face ingredients", got from measurable examination of numerous photos of appearances. Any human face can be thought to be a mix of these standard countenances. For instance, one's face may be made out of the normal face in addition to 10% from eigenface 1, 55% from eigenface 2, and even - 3% from eigenface 3. Remarkably, it doesn't take numerous eigenfaces joined together to accomplish a reasonable guess of generally faces. Likewise, in light of the fact that a man's face is not recorded by a computerized photo, yet rather as only a rundown of qualities (one worth for each eigenface in the database utilized), substantially less space is taken for every individual's face. The eigenfaces that are made will show up as light and dull territories that are orchestrated in a particular example. This example is the means by which distinctive elements of a face are singled out to be assessed and scored. There will be an example to assess symmetry, if there is any style of facial hair, where the hairline is, or assess the measure of the nose or mouth. Different eigenfaces have designs that are less easy to distinguish, and the picture of the eigenface might look next to no like a face. The strategy utilized as a part of making eigenfaces and utilizing them for acknowledgment is additionally utilized outside of facial acknowledgment. This system is additionally utilized for penmanship investigation, lip perusing, voice acknowledgment, communication through signing/hand signals translation and therapeutic imaging examination. Along these lines, some don't utilize the term eigenface, yet want to utilize 'eigenimage'.

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B. Practical Implementation:

To create a set of eigenfaces, one must:

1. Set up a preparation set of face pictures. The photos constituting the preparation set ought to have been taken under the same lighting conditions, and should be standardized to have the eyes and mouths adjusted over all pictures. They should likewise be all resample to the same pixel determination. Every picture is dealt with as one vector, just by linking the columns of pixels in the first picture, bringing about a solitary line with r × c components. For this execution, it is accepted that all pictures of the preparation set are put away in a solitary lattice T, where every column of the framework is a picture.
2. Subtract the mean. The average image **a** has to be calculated andthen subtracted from each original image in **T**.
3. Calculate the eigenvectors and eigenvalues of the covariance matrix**S**. Each eigenvector has the similar dimensionality (numberof components) as the original images, and thus can itself be seenas an image. The eigenvectors of this covariance matrix aretherefore calledeigenfaces. They are the headings in which the pictures vary from the mean picture. Usually this will be acomputationally expensive step (if at all possible), but the practicalapplicability of eigenfaces stems from the possibility to computethe eigenvectors of **S** efficiently, without ever computing **S**explicitly, as detailed below.
4. Choose the principal components. The D x D covariance matrixwill result in D eigenvectors, each representing a direction in the $r \times c$-dimensional image space. The eigenvectors (eigenfaces) withlargest associated eigenvalue are kept.

IV. EXPERIMENTAL RESULTS

We now think of some as basic analyses which represent the coordinating execution of eigenface method for face acknowledgment. We figure the execution of these methods when the foundation is known and the lightning conditions remains practically unaltered. The experiment consist of two phases

1. Training phase: Here we make a training set of faces.
2. Recognition phase: Here the trained faces are identified.

The experiment consist a trial set of 4 different persons. The Experimentwas conducted with 100 trials and the accurate trials are noted down. We considered 4 different sample faces including faces of Chaitanya, Anis, Aniket and Sagar. Three tables are given here with the experiment results. The Table 1 records the details in which training is done only once whereas in Table 2 the training is done 4 times and in Table 3 the training set is 8.

Student Name	No. of Training Images	No. of Trials Conducted	No. of Trials Succeeded	% Accuracy
Chaitanya	1	20	5	25
Anis	1	20	4	20
Aniket	1	20	6	30
Sagar	1	20	8	40

Table 1. Results For Single training Image

Student Name	No. of Training Images	No. of Trials Conducted	No. of Trials Succeeded	% Accuracy
Chaitanya	4	20	10	50
Anis	4	20	13	65
Aniket	4	20	11	55
Sagar	4	20	14	70

Table 2. Results For Four training Image

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Student Name	No. of Training Images	No. of Trials Conducted	No. of Trials Succeeded	% Accuracy
Chaitanya	8	20	17	85
Anis	8	20	18	90
Aniket	8	20	16	80
Sagar	8	20	18	90

Table 3. Results For Eight training Image

The images listed below shows failure of face recognition for less number of training images and success of face recognition for more number of training images. Figure 6 shows the failure of face recognition for single training image, while figure 7 shows success of face recognition for 8 sample images.

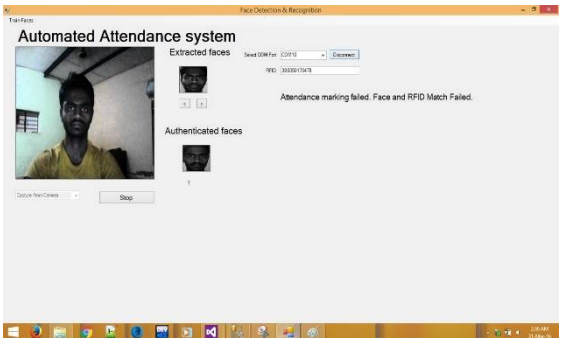

Figure 6: Failure of face recognition for single training image

Figure 7: Success of face recognition for 8 sample images

V. CONCLUSION

This paper symbolizes a student's attendance system via RFID and Face Recognition. Typically students attendance is marked by the professors manually which spends a lot of time causing in wastage of lecture. Alsoamount of proxies gets recorded in manual system. This can be substituted with computerized system. RFID will mark the attendance robotically when student's tag is passed through the scanner and student is enters the class. While face recognition will assist in validating student and marking the attendance of that individual student ensuring avoidance of proxies.

VI. FUTURE SCOPE

Generally, we are using Haar's Classifier and Eigen face identifier in combination, but in near future, to enhance the accuracy and performance of face recognition we can use PIFR (Pose Invariant Face Recognition) along with high

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definition cameras. PIFR needs CMU-PIE database to store sample images. It can recognize face in any position, any pose and in any emotion.
Metallic tags and high capacity readers can be used as a substitute of current RFID readers in near future to enhance the range of readersupto 50 metres.

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