IOT Approach for Management of Attendance System based upon Face Recognition Methodology of Image Processing

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Abstract: *Taking attendance in class of Students is Crucial and very important task. Traditional way attendance taking is manual. And if it follows it tends to waste a important time of decided task. For this few automatic methods are existing. Existing methodology also tends to waste of time, if we taking biometric attendance on account then it also have some pitfalls because program fellow have to make a queue to give attendance by touching their thumb on the electronic biometric scanning device.altimately this approach follows same pitfall of traditional way.*

In the era of IOT solution to above problem should be take advantages of newly innovated IOT approach. Proposed methodology which is also based on IOT and it gives an efficient way that automatically takes the attendance of program fellows without any human interaction. In This methodology attendance is recorded by using a smart device that is nothing but camera which is fixed in front of class venue that is continuously capturing real time data that is images of program fellow, it detect the faces and, compare it with the image database and mark the attendance. We propose real time face detection approach with an existing Learning Management System (LMS),it automatically detects and registers program fellow attending on a lecture. The system represents a additional tool for instructors, with approach used in machine learning with adaptive methods used to track facial changes during a longer period of time. This proposed system have goal that time reduction for attendance and which is ultimately less than traditional methodology.

Keywords: Internet of Things (IOT), Face Detection (FD), Image Enhancement (IE), Enrollment, Verification.

INTRODUCTION:

Keeping record of the attendance is crusial and very important task in all the educational institutes for the purpose of checking and evaluation performance of program fellow. Every educational institute having their own methodology and approaches as per nature of institute. Most of educational institutes taking attendance by traditional way (manually) using the paper as well as files this paper based approach also effect on environments. Because after specific time paper become waste which is harm to environment. Some of the institute moving to the automatic attendance system using biometric approach. But this methodology leads to waste of time of program fellow (students) because to give attendance they should wait for long time in queue for making attendance. Mathematically we can state the biometric attendance require times in following manner ,if for one student device taking ***T*** unit of time then if program offers for ***N*** fellows then this biometric attendance system requires total time for complete task is ***T*N*** unit. Existing biometric system contains first process that is process of enrolment in this unique features and features may be Fingerprints, Eye-Iris, Face, Voice of a program fellow are fetched and store to database .And second step comes which is identification process and last one comes verification process. Identification and verification processes compare program fellow's biometric features which was stored by process one that is process of enrolment. Proposed system architecture works on the face recognition methodology for the automatic or smart attendance of program fellow in the class venue. Without instructor or program fellows intervention. We are proposing combine approach that is IOT and image processing. Once enrollment process over then Camera can detect automatically object which comes in front of it. Here as feature we are using face. Face recognition requires two steps, in first step is called identification in this faces of program fellow are detected and second step verification in this it will compare with which stored in enrolment process .Big difference in between biometrics and proposed methodology is that here no need to wait T*N unit time because of real time face capturing which comes under the IOT. This system architecture utilizes the algorithm for the detection of faces in the class venue image. Face recognition techniques can be divided into two types Appearance based which use texture features that is applied to either whole face or some specific part of face, second one is Feature based in this it takes on

account geometric features like mouth, nose, eyes, eye brows, cheeks and relation between them.

SYSTEM CONSTRUCTION:
I) System Modules
II) Architecture of System
III) Algorithms
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I) System Modules:
a) ENROLLEMENT OF PROGRAM FELLOW
b) DETECTION OF FACE
c) RECOGNITION OF FACE
d) MANAGEMENT OF ATTENDANCE

a) ENROLLEMENT OF STUDENT
First step comes in every biometric system is the enrollment of program fellow. With the help of camera Image is captured then it is enhanced using histogram equalization and noise filtering. In the second step face is detected in the image and features are extracted from it. These unique features are then stored in the face database with certain id of that person. At the time of enrollment templates of face images of individual students are stored in the Face database.

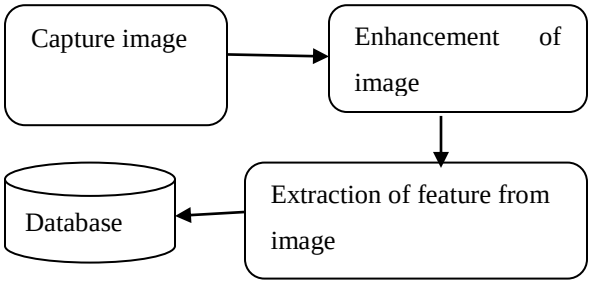

Fig.1: Process of Enrollment

b) DETECTION OF FACE
Face detection methods are often classified into two main categories Feature Based Approaches and Image Based Approaches.

I) Feature Based Approaches:
Feature based approaches include methods based on edges, lines, and curves. Basically depend on structural matching with textural and geometrical constraints. For instance, in edge representation, works by drawing face lining from images to locate facial features.

1. Low-level analysis:
Low-level analysis deals with the segmentation of visual features using pixel properties such as gray-scale and color. Because of the low-level nature, features generated from this analysis are ambiguous, as we make our goal at higher accuracy, we may consider some other approaches that can generate more explicit features.

2. Feature analysis:
In feature analysis, visual features are organized into a more global concept of face and facial features using information of face geometry. Through feature analysis, feature ambiguities are reduced and locations of the face and facial features are determined. Features are invariant to pose and orientation change. Facial features are difficult to locate because of corruption such as illumination, noise, and occlusion. Also it is difficult to detect features in complex background.

3. Active shape models:
Models have been developed for the purpose of complex and non-rigid feature extraction such as eye pupil and lip tracking. Active shape models depict the actual physical and hence higher-level appearance of features. Once released within a close proximity to a feature, an active shape model will interact with local image features (edges, brightness) and gradually deform to take the shape of the feature

ii) Image-based approach:
Face detection by explicit modeling of facial features has been troubled by the unpredictability of face appearance and environmental conditions. Although some of the recent feature-based attempts have improved the ability to cope with the unpredictability, most are still limited to head, shoulder and part of frontal faces. There is still a need for techniques that can perform in more hostile scenarios such as detecting multiple faces with clutter-intensive backgrounds. image-based approaches ignoring the basic knowledge of the face generally work by recognizing face patterns from a set of given images, mostly known as the training stage in the detection method. After this initial stage of training, the programs may be able to detect faces which are similar to the face pattern from an input image. Comparison of distance between these classes and a 2D intensity array extracted from an input image allows the decision of face existence to be made. Most of the image-based approaches apply a window scanning technique for detecting faces. The window-scanning algorithm is merely an exhaustive search of the input image for possible face locations at all scales. An example of these approaches involves linear subspace method such as principal component analysis (PCA) and linear discriminant analysis (LDA). It functions by expressing the principal component of face distribution by eigenvectors. When this analysis is done, each training face can be represented as a linear component of largest eigenvectors, forming Eigen faces.

Applying a different technique in image-based approaches, the Neural network approach which is trained to use multiple layer with different receptive fields. Then merging is done on the overlapping detections within one network. An arbitration network has been trained to combine the results from different networks. This neural network approach is also classified as image-based approach because it works by identifying face patterns

Fig 2: A typical classroom

Fig 3: Extracted images

c) RECOGNITION OF FACE

Face recognition system passes through three main phases during a face recognition process.

1) Face library formation phase: - In this phase, the acquisition and the pre-processing of the face images that are going to be added to the face library are performed. Face images are stored in a face library in the system. We call this face database a "face library" because at the moment, it does not have the properties of a relational database. Every action such as training set or Eigen face formation is performed on this face library. Face library is initially empty. In order to start the face recognition process, this initially empty face library has to be filled with face images. At the moment, scanner or camera support is unavailable. In order to perform image size conversions and enhancements on face images, there exists the "pre-processing" module.

2) Training phase: - After adding face images to the initially empty face library, the system is ready to perform training set and Eigen face formations. Those face images that are going to be in the training set are chosen from the entire face library. Because that they face library entries are normalized, no further pre-processing is necessary at this step. After choosing the training set, Eigen faces are formed and stored for later use.

3) **Recognition and learning phase: -** After choosing a training set and constructing the weight vectors of face library members, now the system is ready to perform the recognition process. User initiates the recognition process by choosing a face image. Based on the user request and the acquired image size, pre-processing steps are applied to normalize this acquired image to face library specifications (if necessary). Once the image is normalized, its weight vector is constructed with the help of the Eigen faces that were already stored during the training phase. After obtaining the weight vector, it is compared with the weight vector of every face library member within a user defined "threshold". If there exists at least one face library member that is similar to the acquired image within that threshold then,the face image is classified as "known". Otherwise, a miss has occurred and the face image is classified as “unknown".

d) MANAGEMENT OF ATTENDANCE

Last phase comes in this process is nothing but management of attendance. By detecting and recognizing face of program fellow attendance is marked on the attendance management server. Proposed system applies specific protocol for the management of attendance. Program time table is also with the proposed system, which gets the subject, class, date and time by its own. Program instructor come in the program venue and just press a button to start the attendance process and the system by its own gets the attendance without any the interference of program fellow and program instructor. By this way a too much time will save. And notable importance is that this is very highly secure process. no one can give the attendance of other. Attendance is maintained on the server so anyone can access it for it purposes like administration, parents and students themselves.

ARCHITECTURE OF SYSTEM

While many previous face recognition systems have been designed and quoted their superior performances using extremely optimized and controlled environments, our system has been developed to match such successful performances

with a number of conditions unconstrained. With the implementation of various normalization stages, the face recognition system has been designed to perform recognition on images where the faces are subjected to different scaling, rotation and illumination. Images containing more than one face can also be processed, but only one face will be identified per input image.

Due to the difficulty in producing a robust system that can operate under any environment and face orientations, two modes of operations have been devised for this system, static mode and dynamic mode. Under static mode, recognition is performed on still images captured under a constrained environment. It is assumed that faces are properly scaled and without rotation, such that the unreliable scaling and rotational normalization modules can be omitted during static mode operations.

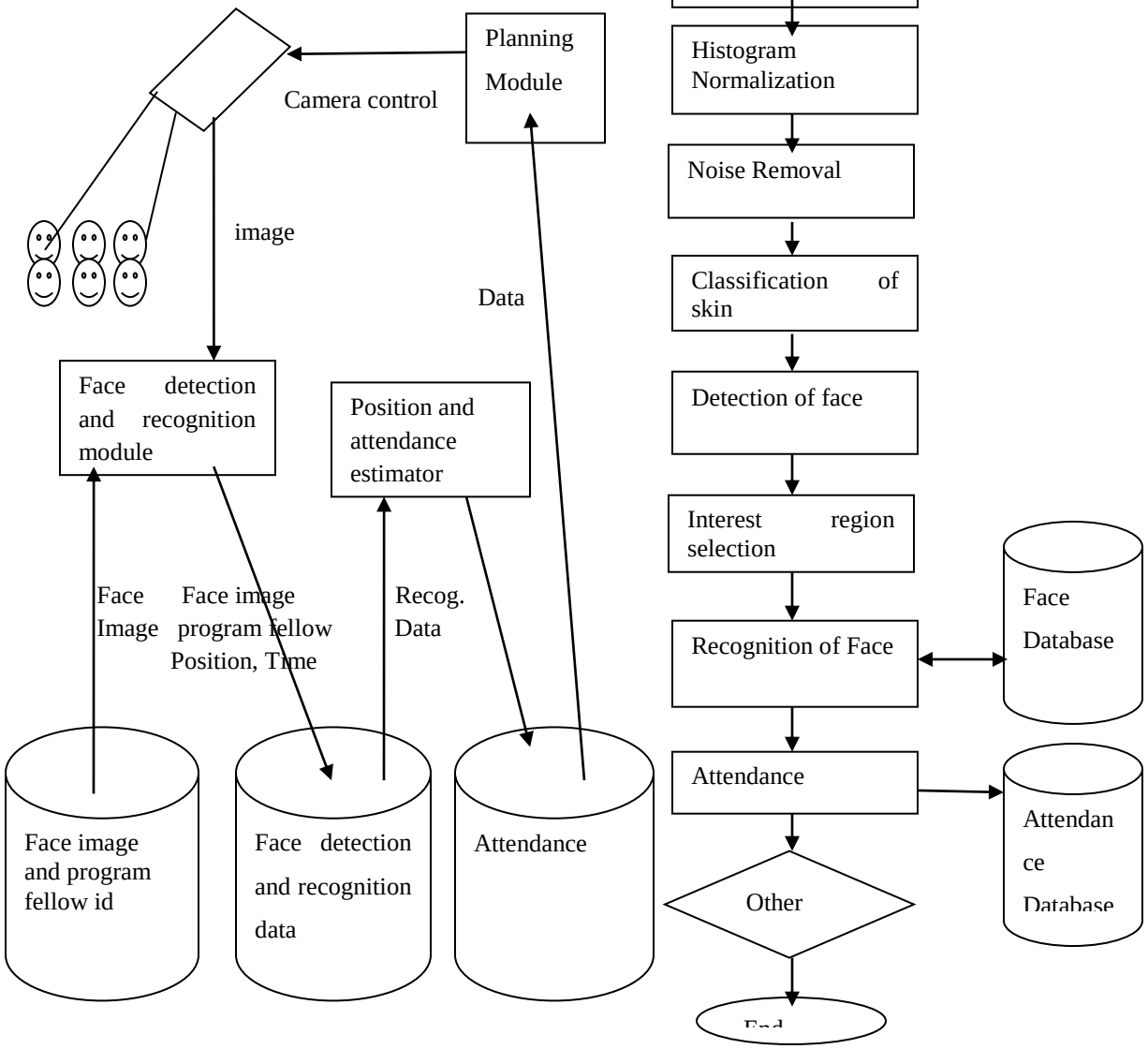

Fig 4: Architecture of System

ALGORITHMS:

Here we are proposing required algorithms to build system. The system consist following algorithm

1. Acquisition of image
2. Histogram normalization
3. Noise removal
4. Classification of skin
5. Detection of face
6. Recognition of Face
7. Attendance of fellow

1. Acquisition of image:
Image is captured from a high definition camera that is set above the teaching board or we can use camera of personal laptop. It captures images after every specific time interval set by us and sends these images to the computer for further processing.

Fig.5: Input image

2. Histogram Normalization:
To get better result we are converting captured image into grayscale image(R=G=B). Then we are applying histogram normalization methodology.

Fig.6: Gray Scale Image:

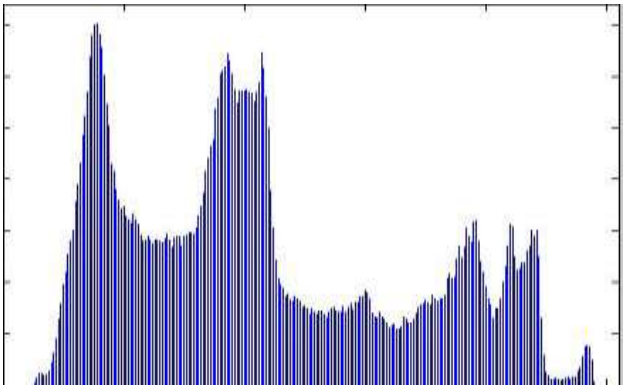

Fig.7: Histogram of Gray Scale Image

Histogram normalization is good technique for contrast enhancement in the spatial domain.

Fig.8: Histogram Equalized Image

In grayscale image all images we can seen.

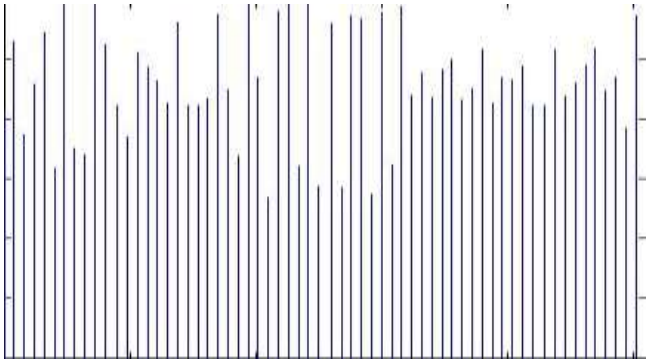

Fig.10: Histogram of Equalized image

3. Noise removal
Various noise may be present in image due to some technical error.To get better result removal of noise is important task and there are many methodology are present to remove noise In proposed system median filtering in is used for noise removal .

4. Classification of skin
To improve efficiency of the face detection Algorithm we are focusing on classification on skin. for this we are using binary image in this pixel which is closely related to skin color consider as white(one) and remaining black(zero) and binary image uses the threshold value of skin colors.

5. Detection of face
We are using Haar classifiers for detection of face. For testing purpose initially face detection algorithm tested on different images with different face positions or different angel and lighting conditions and then we are algorithm applying to detect faces in real time video.

Fig.11: Face Detection

After detection step comes that is cropping of each image and this is as follows

Fig.12: Cropped Faces

6. Recognition of Face:

Important step in system is recognition of face and for this we are using cropped images and applying face recognition methodology. Eigen Face method we are using for recognition of face and automatically attendance is marked on the server.

CONCLUSION

Proposed system gives efficient and best r This paper presents the efficient and best methodology of attendance in the program venue and this is replacement of traditional way of attendance making. Proposed methodology aims to give secure reliable and user-friendly service. And here we not require extra hardware It can be done using a separate camera or laptop camera also

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