Classroom Attendance Using Face Detection and Raspberry Pi

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Abstract: **In this paper we propose an attendance management system. This system is based on face detection and recognition. Initially when staffs stand in front of the camera, it detects and recognizes that staff's face and generates attendance to that particular staff. The system architecture and algorithms used in each stage are described in this paper. When compared to traditional attendance marking this system saves the time and also helps in maintaining staff's attendance.**

*Keywords-***Face Recognition, Face Detection, Image capture, Feature Extraction, Feature classification.**

I. INTRODUCTION

Maintaining the attendance is very important in all the institutes for checking the performance of employees. Every institute has its own method in this regard. Some are taking attendance manually using the old paper or file based approach and some have adopted methods of automatic attendance using some biometric techniques. But in these methods employees have to wait for long time in making a queue at time they enter the office. Many biometric systems are available but the key authentications are same in all the techniques. Face detection and recognition are important application of Image processing owing to its use in many fields. Identification of individuals in an organization for the purpose of attendance is one such application of face detection and recognition. The prevalent techniques and methodologies for detecting and recognizing face fail to overcome issues such as scaling, pose, illumination, variations, rotation, and occlusions. The proposed system aims to overcome the pitfalls of the existing systems and provides features such as detection of faces, extraction of the features, detection of extracted features, recognition of face and analysis of staffs' attendance. Faces are recognized using Euclidean distance and k-nearest neighbour algorithms.

The system is tested for various cases. We consider a specific area such for marking attendance, for the purpose of testing the accuracy of the system. The metric considered is the percentage of the recognized faces per total number of tested faces of the same person.

An Attendance Management System which is developed using bio-metrics,in our case face, generally consists of Database development, Face detection, Pre-processing, Feature extraction and Face Recognition. The subsequent sections in this paper are literature survey, detailed description of variousstages in the proposed model, results and conclusions and scope for improvement.

II. LITERATURE SURVEY

In [1] the authors have proposed a finger print based attendance system. A portable fingerprint device has been developed which can be passed among the students to place their finger on the sensor during the lecture time without the instructor's intervention. This system guarantees a fool-proof method for marking the attendance. The problem with this approach is that passing of the device during the lecture time may distract the attention of the students. A number of works related to Radio Frequency Identification (RFID) based Attendance Systems exist in the literature. In [2] the authors have proposed RFID based system in which students carry a RFID tag type ID card and they need to place that on the card reader to record their attendance. RS232 is used to connect the system to the computer and save the recorded attendance from the database. This system may give rise to the problem of fraudulent access. An unauthorized person may make use of authorized ID card and enter into the organization. Iris is the another bio-metric that can be used for Attendance Systems. In [3] the authors have proposed Daugman's algorithm based Iris recognition system. This system uses iris recognition management system that does capturing the image of iris recognition, extraction, storing and matching. But the difficulty occurs to lay the transmission lines in the places where the topography is bad. In [4] authors have proposed a system based on real time face recognition which is reliable, secure and fast which needs improvement in different lighting conditions.

III. PROPOSED METHOD

The proposed attendance management system is based on face recognition .when a person stands in front of the camera, it detects and recognize the person based on already stored test samples and the ID given. No two persons should stand in front of camera during the face detection.
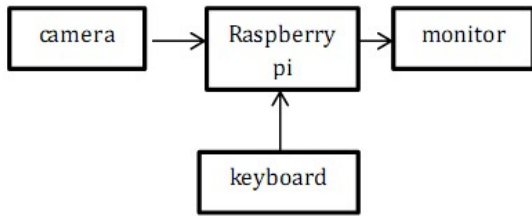
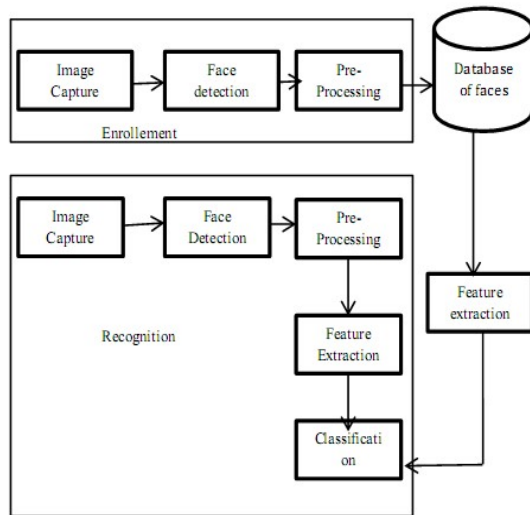Fig:3.1 Block diagram showing major components of the system

Fig.3.2. System Architecture

A. Image capture

All the test sample images that are stored re captured using web camera.

B. Face Detection

A proper and efficient face detection algorithm always enhances the performance of face recognition systems. Various algorithms are proposed for face detection such as Face geometry based methods, Feature Invariant methods, Machine learning based methods.

C. Pre-processing

The detected face is extracted and subjected to preprocessing. This pre-processing step involves with histogram equalization of the extracted face image.

D. Database development

As we chose biometric based system enrollment of every individual is required. This database development phase consists of image capture of every individual and extracting the bio-metric feature, in our case it is face, and later it is enhanced using pre-processing techniques and stored in the database. In our project we have taken the images of individuals in different angle. A database of 5 images of each individual is collected for this project.

E. Feature Extraction and Classification

The performance of a Face Recognition system also depends upon the feature extraction and their classification to get the accurate results. Feature extraction is achieved using feature based techniques or holistic techniques.

F. Post-processing

In the proposed system, after recognizing the faces of the staffs, the names, ID, Date, In time and out time of a particular staff shown in database.

IV. IMPLEMENTATION

Face detection: It has the objective of finding the faces in an image and probably extract them to be used by the face recognition algorithm.

Face recognition: With the facial images already extracted, cropped, resized and usually converted to grey scale, the face recognition algorithm is responsible for finding characteristics which best describes the image.

There are different types of facial algorithms, among which LBPH algorithm is used here. This algorithm is simple yet very efficient texture operator which labels the pixel of image by threshholding the neighbourhood of each pixel and considers the result as a binary number.

Steps for the local binary pattern algorithm:

1. Parameters: The LBPH uses 4 Parameters.
   - Radius: the radius is used to build the circular local pattern and represents the radius around the central pixel. It is usually set to 1.
   - Neighbours: the number of sample points to build the circular local binary pattern. It is usually set to 8.
   - Grid x: the number of cells in the horizontal direction. The more cells, the finer the grid, the higher the dimensionality of the resulting feature vector.it is usually set to 8.
   - Grid y: number of cells in the vertical direction. The more cells, the finer the grid, the higher the dimensionality of the resulting feature vector.it is usually set to 8.
2. Training the algorithm: First, we need to train the algorithm. To do so, we need to use dataset with the facial images of the people we want to recognise. We need to also set an ID to each image, so the algorithm will use this information to recognise an input image and give you an output. Images of the same person must have same ID.
3. Applying the LBP operation: The first computational step of LBPH is to create an immediate image that describes the original image better way, by highlighting the facial characteristics. To do so the

algorithm uses the concept of sliding window, based on the parameter radius and neighbour.

4. Extracting the histogram: Now, using the image generated in the last step we can use the GridX and GridY parameters to divide the image into multiple grids.
5. Performing the face recognition: In this step, the algorithm is already trained.
Each histogram created is used to represent each image from the training dataset. So given an input image ,we perform the steps again for this new image and creates a histogram which represents the image.

- So to find the image that matches the input image we just need to compare two histograms and return the images with closest histogram.
- We can use various approaches to compare the histograms (calculated the distance between the two histograms) , for example : Euclidian distance, chi-square test, absolute value,etc..,in this example we use Euclidian distance(which is quite known) based on the following formula:

$$D=\sqrt{\sum_{i=1}^{n}(hist1 - hist2)}$$

- So the algorithm output is the ID from the image with the closest histogram. The algorithm should also return the calculated distance ,which can be used as a confidence measurement.

V. HARDWARE COMPONENTS

A. Raspberry Pi

We use latest version of Raspberry Pi. In this we have inbuilt Bluetooth and Wifi. There are total 40 pins, 26 pins are GPIO pins and others are power or ground pins. There are 4 USB port, 1 Ethernet slot, 1 HDMI port, 1 audio output port and 1 micro USB port.

B. Keyboard

It is used to type the commands to run the python code. Using the user interact with the system.

C. Mouse

It is used for the user to interact with the system.

D. Web Camera

It is a video camera that feeds are streams its image in real time to or through a computer to a computer network.

VI. SOFTWARE COMPONENTS

A. OpenCV

(open source computer vision library) is an open source computer vision and machine learning software library. It was built to provide a common infrastructure for computer vision applications and to accelerate the use of machine perception in the commercial products. Being a BSD –licensed product, it makes it easy for Business to utilize and modify the code. The library has more than 2500 optimized algorithms. These algorithms can be used to detect and recognize faces, identify objects etc.

B. Raspbian Operating System

This is the recommended OS for Raspberry pi. Raspbian operating system is Debian based operating system. It comes with over 35,000 packages, pre-compiled software bundled in a nice format for easy installation on your *Raspberry* Pi. We can install this from Noobs installer.

C. Local Server

Attendance system should also have a website backup where all the updates in attendance records could be seen. For this a server is needed which could host the website, and Raspberry pi is used for the same . The website of "Attendance Management System" is developed to provide a platform to view the attendance. This website is developed on the server-side scripting language –PHP, the style sheet language –CSS which is used, for look and formatting of a document written in a mark-up language. This website uses MySQL database which is world's most widely used open source relational database management system (RDBMS).

VII. CONCLUSION

Based on the requirements of an automated attendance system this servers as a whole system for managing attendances in schools and colleges. It presents a design and framework for taking attendance and thereby making troublesome process of taking and compiling of attendance simple and efficient. So this prototype is not only cheaper, efficient, having low power design, upgraded for any other type of data acquisition system, easy to use.

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