

Face Recognition based Smart Attendance System Using IoT

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Abstract - Face recognition based smart attendance system using IoT is a tool for recognizing the students face while taking attendance by using face biometrics based on monitor camera image capturing. In our face recognition based smart attendance project, a raspberry pi system will be able to find and recognize human faces fast and precisely in images. The long-established method of calling name of each student is tedious and there is always a chance of proxy attendance. The proposed system is based on face recognition to maintain the attendance record of students. As the process of attendance taking starts the system takes pictures of the attendees and then applies face detection and recognition technique to the given image and the recognized students are marked as present and their attendance is updated with corresponding time, student name and register number. We have used deep learning techniques to develop this project.

Key Words: Biometric Attendance, Face Recognition, OpenCV, Raspberry Pi, Camera

1. INTRODUCTION

Education institutes these days are concerned about the consistency of students' performance. One explanation for this decrease in student performance is the inadequate attendance. The long-established attendance was taken manually that is incredibly time overwhelming and infrequently results in human error. The old technique that uses paper sheets for taking students' attendance will now not be used. This project aims for computer-based student attendance taking system that supports the institutions to keep records of attendance. We have proposed to implement a "Face Recognition based Smart Attendance System Using IoT". The present implementation includes facial identification that is time saving and eradicates the probabilities of proxy attendance due to the facial detection. This system will currently be utilized in a section during which participation plays a vital role. Raspberry Pi, Python and OpenCV are the basic requirements for this system. The system implementation uses webcam as input device to identify the face of the person in real-time.

This project on face recognition based smart attendance system using IoT aims to replace the manual attendance system with automated attendance system. As all the data is stored online in this proposed system, offline registers will become irrelevant, making the maintenance of records easier. Nowadays attendance is considered as a prime factor for both the students and the educational institution.

Manual attendance is considered as a time-consuming process or sometimes it happens for the teacher to miss someone or students may answer multiple times on the absence of their friends (proxy attendance).

Biometric attendance is automated method of verifying or recognizing the identity of a living person on the basis of some physiological characteristics, such as fingerprints or facial features, or some aspects of the person's behavior. Since biometric systems determine someone by biological attributes, they are tough to forge. Face recognition is one among the few biometric ways that has the veracity of a physiological approach while not being intrusive.

Face Recognition is a type of biometric software that maps an individual's facial features mathematically and stores it as a face print. The system uses deep learning techniques to compare a live capture or digital image to the stored face print in order to verify an individual's identity. Once the recognized face matches a stored image, attendance is marked in corresponding excel sheet for that person. The other reason for taking face recognition as biometric parameter is this technology reduces the physical touch of objects/records providing a contagious-by-touch free environment which the whole world is adopting these days. Automated attendance system using machine learning approach automatically detects and recognizes face and marks attendance which saves time and maintains a record of the collected data.

1.1 Objectives

Our primary objective is to help the lecturers/teachers, improve and organize the process of tracking and managing student attendance. Additionally, this:

- Provides a valuable attendance service for both teachers and students.
- Increases security and proxy attendance won't be possible.
- Provides error free, automated and reliable attendance report.
- Uses face recognition technology which reduces the physical touch of objects/records providing a contagious-by-touch free environment.

2. Problem Statement

The present system of taking attendance is either by manual or by using finger impression as biometric parameter. Manual /Traditional attendance is usually taken by calling students by name which takes a lot of time and has a chance of errors and proxies which makes the analysis of student performance imprecise. The maintenance of record for this type of attendance is time consuming and resource consuming. Attendance by using finger impression as biometric parameter is done by taking finger print as biometric parameter which is in use in many places, which may not be a time-consuming process compared to manual attendance, however, keeping the recent pandemic in mind it is not safe to touch the finger print recognition sensor repeatedly without a huge time gap. Also, this type is high maintenance. So, there is a need for new attendance system which has no lecturer interference and has a contactless device.

3. Proposed System

The proposed system is designed to capture the face of each student and to store it in the database for their attendance. The face of the student needs to be captured in well-lit room so that student's face features can be detected, the seating and the posture of the student need to be recognized. With this system, there is no need for the teacher to manually take attendance in the class because the system records a video and through image processing/image training the face is recognized and the attendance database is updated in a spreadsheet. The proposed system uses Raspberry Pi as computer and a webcam for capturing the images.

3.1 Methodology

Facial recognition Methodology is being widely used in many projects as it has many advantages. There is requirement of data for the system in order to trace and track the individual and mark his/her attendance. The data is loaded by assigning each individual's image with a corresponding id and name. Once the system starts, the option of taking image is available for which the pre-requirement is the input of id and name. More than 100 images will be taken in gray format using OpenCV. These images will be the input for Haar cascade. Haar Cascade codes the pictures into binary code after converting them into binary image. Once the system is given input, it is trained by clicking on train image option available on the screen using a file called Trainer.yml which is written in human readable data serialization language. The features of the face will be detected and stored for further actions. The dataset has to be created in the above said manner to further recognize the faces when needed. Track images option is used for detecting and recognizing the faces of individuals. After detecting the face of each individual, attendance will be marked in spreadsheet along with the corresponding date and time.

3.2 Algorithm

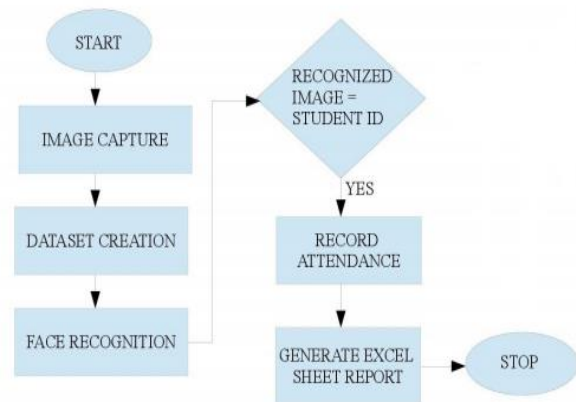


Fig -1: Depiction of the flowchart architecture and process of the designed system

The proposed system works in the above shown way. Once the system is activated it asks for the input which are the live image of student, Student name and Id. After storing and training the system will be ready to be used that is to track images and produce attendance report.

1. Capture the Student's Image
2. Apply Haar Cascade (Face Detection)
3. Extract the Rectangular Bounding Box
4. Convert to gray scale, apply histogram equalization and Resize to 100x100
5. if Updating Database then
 - Store in Database
 - else
 - Apply LBPH (For feature Extraction)
 - end if

Post-processing

The system records a short video as input and using image processing/image training the face is recognized and the attendance database is updated in a spreadsheet in the way it is shown in the above pseudo code.

3.3 Architecture

Raspberry Pi 3 Model B V1.2 is used in the project as remote device that acts as computer for the system which is connected to power supply by using an adapter. The device is supplemented with a webcam and memory card to take the images and store the contents of Pi respectively.



Fig -2: Depiction of Architecture of the project

4. Project Description

Running the project:

- Raspberry Pi is given power supply using the adapter.
- Raspberry Pi and Computer are connected to the same WLAN.
- Advanced IP Scanner is used to find the IP Address of pi.
- The IP Address is used to log into raspberry pi using VNC Viewer

Dataset creation:

- There are two slots to enter the ID number and name of the student respectively.

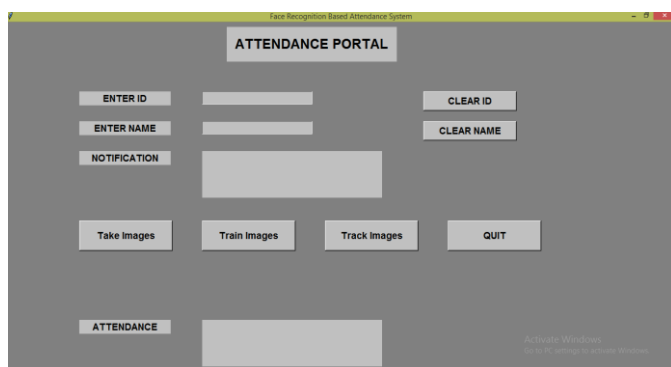


Fig -3: Attendance portal with the slots to fill Name and ID

- Image taking: Image is captured using definition camera and the image is saved. For a better accuracy, multiple number of images will be taken. This process is done using the 'take image' option. A message will be displayed in the notification box once the image is successfully captured and saved. For all the said process external webcam is used which is connected to raspberry pi.

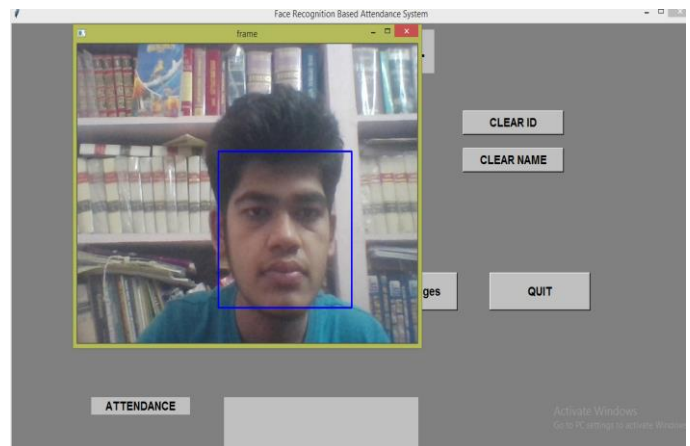


Fig -4: Taking image of the user to store in database

- Training: After the taking the image, by clicking on 'train image', the image will be saved along with the entered student ID number and name. A message will be displayed in the notification box once the image is successfully trained.

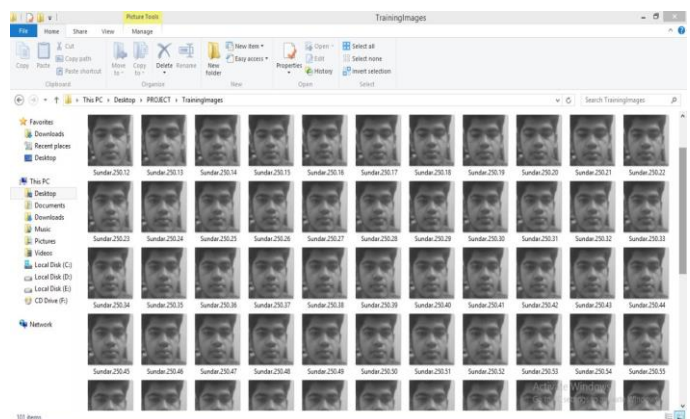


Fig -5: Dataset of trained images

Attendance taking:

If the dataset is not created, the process stated above has to be followed. If dataset is created and attendance is to be taken:

- By clicking on track images camera starts capturing images and detects the face of the student, thereby marking his/her attendance in the spreadsheet with the corresponding time and date, ID number and name. Once attendance is taken pressing 'q' closes the camera.
- Haar cascades is used to detect and recognize the faces and it uses machine learning techniques in which a function is trained from a lot of positive and negative images. This process in the algorithm is feature extraction.
- Quit option is given to close the portal.

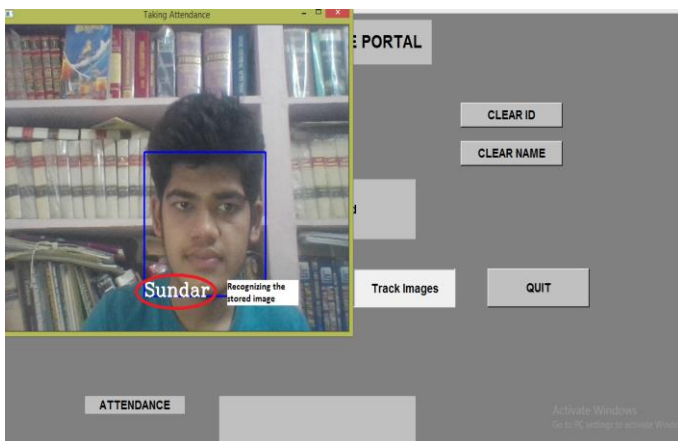


Fig -6: Face Recognition

- Notification box is given to display the corresponding message as a consequence of the action of user.

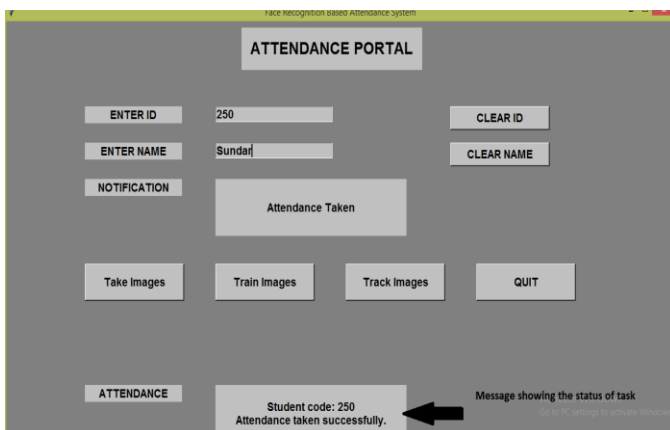


Fig -7: Message showing that attendance is taken successfully

5. Result

Face Recognition based Smart Attendance System Using Internet of Things is simple for usage and works efficiently. The system works automatically once the registration of individual student is completed and dataset is created.

The project results the following:

- Time-saving
- More efficient
- Real-time
- Precise
- Automatic report in spreadsheet
- Online updation is easy

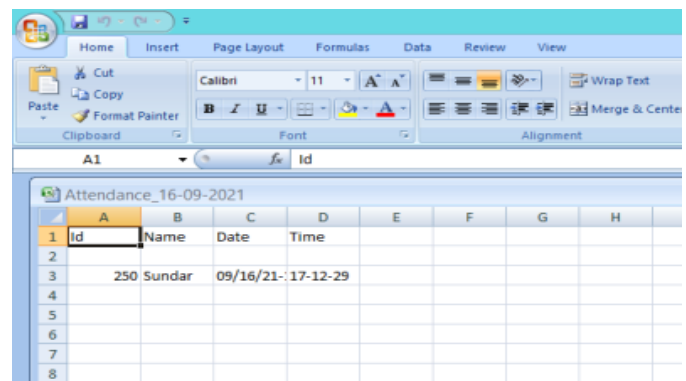


Fig -8: Attendance is saved in excel sheet as shown

6. Conclusion

This paper on face recognition based smart attendance system using IoT features one of the best ways of attendance marking system which is time-saving, more efficient, real-time, precise, gives automatic report in spreadsheet, makes online updation easy. The system has been implemented using Raspberry Pi, Webcam, OpenCV, Haar cascade and python. Haar cascade, one among the finest face detection algorithmic program is used to confirm the standard of the system. Face Recognition based Smart Attendance System Using IoT is simple for usage and works efficiently. The system works automatically once the registration of individual student is completed and dataset is created. The project is designed addresses many of the issues of existing manual systems and finger print based biometric system. Face recognition concept to mark the attendance of student and makes the system better and efficient. This project can substitute all other attendance systems and performs efficiently. The Automated Classroom Attendance System helps in increasing the accuracy and speed ultimately achieving precise attendance to meet the need for automatic classroom evaluation. The purpose of the paper to reduce errors and human effort in traditional attendance taking is achieved via face recognition based attendance system. The result shows the potential of our system to deal with the problem stated in chapter 2

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Biographies



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