Face Recognition and Database Management System for Event Participant Authentication

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Abstract. Physical uniqueness among each and every individual is the key factor for their identification. This paper discusses an Event participant authentication system that uses face recognition technology to facilitate the management of events conducted by organizations. The system identifies and authenticates participants in less time and eliminates organizers’ involvement. It uses database management to maintain the records of participants successfully registered for an event along with their images stored in the database. With high speed and accuracy, the facial recognition system will find out if a person is registered and authenticated to participate in an event or not. Also, the system ensures that the participant's details are correct, and more number of participant's verification does not delay the event unlike when the manual verification is performed using an excel sheet or E-mail validation.

1. Introduction
There are lots of events happening around us every day and participating in these events became a necessity to learn and share information among a group of people. Hackathons, Webinars, and Workshops in Colleges; Employee Verification in Software Companies and Workers Identification in Industries are some important events happening frequently. These events are not open to all and they allow individuals who have successfully registered for the event after payment, only those who are employees of the company, or members of the project team. It is very easy to manually check on participants when the event population is minimum. But, when the event participation is high, it becomes a difficult task for the organizers to properly check on them and verify their details. As a result of this, the event schedule is affected. The delay at the beginning of the event will result in reducing event duration or extending event ending time, thus affecting the event flow. This calls for an authentication system that would help us to speed up the participant authentication process of an event.

2. Existing Systems
The Existing Systems does the authentication of people based on RFID Technology, QR code scanning, Fingerprint-based Technology, Iris based system and Face Recognition systems. The event organizers may perform verification of participants with their ID Card which may have an RFID chip in it or barcode in it. Scanning them gives us their unique key details which will be compared with the database
of registered participants and verified. High cost and misuse of the technology to give proxy are drawbacks of the system. Using QR Code is another option for verification of participant in which scanning of the QR code gives their unique identification primary key that helps in retrieving their complete details from the database and show them on the screen. The registration portal sends the participants, a confirmation email within 24 hrs on successful payment and registration for the event. QR code error and no instant alternative if QR code is missed by the participant is a drawback. Advancements in technology allowed us to use the iris of a person for his identification. Iris based system considers the image of the iris as its unique key for user identification. But, this system needs more time than verification using QR code as it needs to focus on the person’s eyes properly each time. The Face recognition system recognizes the face of a person and uses concepts of machine learning to determine his identity. This system is good only when the machine learning model accuracy is higher which requires multiple images of an individual. Also, it varies with the image set in the database and may tend to be less for some image sets. There are various other techniques and feature extraction methods to identify a person with his face. An ideal system must be faster and always accurate through the entire process.

3. Literature Survey
In [1], the authors developed an E-Attendance system that captures an image of the whole class as its input and uses the Convolutional neural network model architecture to process it. All the features in the image are extracted using the Viola-Jones method and stored in a dataset. Then, the dataset runs on the pre-trained Support Vector Machine classification model that predicts the students present in the class from the image features and marks their attendance. This System helps in reducing manual work, but sometimes, the student’s face is not identified in the image and the system doesn't recognize the student faces in the image correctly due to less image quality. The authors of [2] proposed an idea in their Attendance System based on Face Recognition using HOG features of the faces in the image to identify the students and mark attendance. The system has images of all students in the database and uses it to train a machine learning model. But it needs nearly 500 to 1000 captures of each student to recognize them more accurately. In [3], the authors used HOG features of the face with a machine learning algorithm, The Local Binary Pattern Histogram, which can make face recognitions from both front-face and side-face. In [4], the authors proposed the idea of using human iris to identify a person as it is unique for every individual. The Recognition system has the iris images of all persons which are used to match patterns with the live iris image to recognize the person for attendance. It calculates the hamming distance between binary patterns and finds out the perfect match when the distance is very nearly or equal to zero.

In [5], the developed system recognizes faces using the HOG algorithm and does face alignment using the face landmark estimation algorithm. Then using an SVM classifier on these faces after encoding the image, it recognizes and updates attendance in the database. The authors of [6] suggested a system that records the attendance using RFID chips in the student/ employee ID card instead of manual attendance, which is time-consuming and inefficient. This Radio Frequency Identification technique along with the Internet of Things (IoT) applications would make it easier to take attendance efficiently. In [7], the authors discuss an idea to identify a person based on his fingerprint. When he places his finger over the sensor, the sensor takes the fingerprint as input, matches with the database and his unique id gets added to the attendance sheet automatically. But it requires manual registering of fingerprint before the event and people are not comfortable registering their fingerprint in all organizations due to security reasons. In [8], an attendance system that identifies students using QR code generated for their unique roll number was discussed. The faculties handle an android app that marks the attendance for students upon scanning their respective QR code. After complete scanning, the attendance list of students for that day will be updated in the database [9,10].
4. Proposed Methodology

Figure 1 shows the proposed methodology uses face recognition to find out if a person is registered and authenticated to participate in the event or not. The system manages a database to store details of participants along with their clear image under their successfully registered event record. Through image processing, the system authenticates the participants for the respective events. A participant can register for the events with his unique ID like registration number; his individual photo and other required details. When he successfully registers for the event, his details and his photo will be recorded in the folder created in the database for that respective event. The image will be named with the unique ID that helps in retrieving the details of the participant from the database when the face in it is recognized. On the day of the event, when the participants arrive at the venue, the camera placed in an ideal location would help us to track their registration status instantly.

The system starts to localize the bounding boxes for all faces in the image frames of the video. All the faces detected will be encoded and appended to a list dynamically. As soon as the first face is detected in the image frame, the system requests the database and gets the corresponding event image set. The event organizers can access their event’s image set only through the account of the person who created the event on the website. Now, the system recognizes faces in these image set and with the name of the matched image as a unique identity key, it encodes them into another list. All the elements of the first list will be iteratively compared with the elements of the second list and the minimum distance between them will be calculated. The images with minimum distance are more identical while, the image with maximum distance are least related. On finding out the minimum distance between any two images, if the value is less than the threshold limit, the face matches successfully with one of the registered participants’ faces. Now, using the name of the matching image, the system gets all details of the participant corresponding to that unique name to authenticate, mark attendance and show a green rectangle bounding his face in the video. If the minimum distance is found to be greater than the threshold value, it shows a red rectangle bounding his face in the video.

5. System Flow
Figure 2. Flowchart for processing video capture

Figure 2 shows the processing of the image frame from the video input in the image processing module of Face Recognition and Database Management System for Event Participant Authentication. The face recognition phase during the event registration plays the main functional role in the system. Hence, it must be efficient and precise so that the entire system is able to yield better results without any problems. Video Camera must have a high resolution to ensure that participants’ faces are clearly visible to the system. With lower resolution, there is a high chance of the faces not getting recognized properly. The video recording is made up of continuous image frames and consists of moving objects. The captured image frame must undergo a sequence of processing in the system. Firstly, it must be resized by a factor and converted from blue-green-red (BGR) to red-green-blue (RGB) form. Then using the OpenCV library, faces can be localized in the image frame which would return a set of four values x, y, w and h representing the x-coordinate and y-coordinate of the leftmost point of the box bounding the face; and width and height of the bounding box in the resized image. Now, in order to draw a rectangle on all the faces identified in the image, the values x, y, w and h with respect to the original image are required. Hence, the system multiplies all these values by resizing the factor and draws the rectangle in the original image. Meanwhile, parallelly the system finds out if the participants have registered for the event or not and then, decides the colour of the rectangle and the label on it.

6. Results and Discussion

Figure 3. Event Registration Form

Figure 3 shows the registration form for the event. Students can register through form with their name, registration number which is used to identify them uniquely and other required details along with their image.
Figure 4. Output of participant authentication system

Figure 4 shows the output image frame of the captured video whose corresponding image frame is processed, encode and compared with the images under the event in the database. The registered participants are recognized correctly with a green rectangle bounding their face while the unregistered participants’ faces are bound with a red rectangle.

Figure 5. Check-In time updated in the Excel sheet

Figure 5 shows the attendance data of recognized registered participants recorded in the excel sheet with their full name, registration number and check-in time for the event.

Figure 6. Django database with participants details

Figure 6 shows the database for the Event Participant Authentication System which has the record of all the participants registered under the event. Only the admin has access to update the database.

7. Advantages of this system

The proposed system is very fast in recognition and its accuracy can be tuned based on the threshold value. Unlike barcode or QR code system, this system is highly secure and any misuse like giving proxy for others is not possible. There is no investment in RFID chips for the development of this system and hence, it is a cost-effective product. It has a very efficient backend system for making fast comparison and calculations while processing the image frames. A high resolution camera ensures a faster image
frame rate and image enhancement with histogram equalization helps in the identification of maximum faces in the image frame. All these advantageous features make this system stand unique from others.

8. Future Scope of this Idea

This proposed idea can be used to overcome problems faced during online classes conducted on platforms like Zoom Meeting, Microsoft Teams etc. Often, students need to wait for the teachers to approve their request after verification. Implementation of this idea would capture video using a web camera to recognize a face from the image frame and authenticate the student. In colleges and workplaces, class hours are wasted by manual attendance taking. This system can solve that problem by automatically taking attendance using cameras at an ideal location in the class. Theft is a common problem in business places. So, this idea can be used to develop a system that alerts shop-owners to stay careful by identifying a person with previous theft/robbery complaints records. The system can notify the user by sending an original matching image to his device if any customer's face is recognized with the image set in the database.

9. Conclusion

Thus, The Event Participant Authentication System helps to solve the problem by identifying and authenticating the participants at a faster rate with higher accuracy without any manpower and delay. Using image processing for face recognition, face encoding and face comparison, the system captures the video, processes it as image frames, matches it with the image set in the database and shows an individual registration status to event co-ordinators in the live video. It stands out from other existing systems with its identification accuracy even when the participation for the event is high.

10. References

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