IARJSET

ISSN (Online) 2393-8021
ISSN (Print) 2394-1588

International Advanced Research Journal in Science, Engineering and Technology

Vol. 8, Issue 7, July 2021

DOI: 10.17148/IARJSET.2021.8737

A Contactless Attendance System using Real-Time Face Recognition

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Abstract: With an increased workforce, the ability to maintain attendance becomes too complex to be handled by a human or log entry books. Specially to maintain the entry and exit time. Current technologies like fingerprint and other bio-authentication systems require direct contact with the device. But in times like these, when the world is aware of a pandemic, it is important to ensure contactless mechanisms to register attendance. Instead of individually verifying each person, we need a quick mechanism to prevent unauthorized entries into the premise.

Keywords: Pandemic, contactless, attendance, workforce, bio-authentication, finger-print, authorization.

I. INTRODUCTION

The COVID-19 is an unparalleled crisis leading to a huge number of casualties and security problems. The virus can be spread through contact and contaminated surfaces, therefore, the classical biometric systems based on passwords or fingerprints are not anymore safe. Face recognition is safer without the need to touch any device. It is also very important to ensure only authorized people information regarding Employees and their analytics. can enter the premises, this was being done by verifying each individual through physical identity cards. Facial Recognition also eliminates this. The goal is to ensure least interaction and reduce hassle. With so many employees and their data, it is important to store them at a safe and reliable Database. Thus, A Single destination for information regarding Entries and Exits is provided. This Information which is usually just used for attendance purposes can come in handy for various other purposes such as Analytics. Hence, Companies are provided with a dashboard containing employee attendance logs along with the complete analytics like the numbers of hours worked, Total Days Present, Overtime worked.

II. METHODOLOGY

1. A CCTV Camera is Placed in the entrance premises according to the requirements, from which the live video stream is obtained.
2. Images/Frames are captured from the video and are sent to the Dlib Model, A state of the art Facial Recognition Model.
3. The Model Identifies the face and their facial features called as Face Descriptors.
4. These face descriptors are unique for each identity and are stored as 128D NumPy array representing 128 different features on a face.
5. This Array is Compared to the Faces in the Employee Database Using Euclidean Distance.
6. Euclidean Distance is calculated by:

$$D(X,Y) = \left(\sum_{i=1}^{n} |x_i - y_i|^p \right)^{\frac{1}{p}}$$

Fig1. Euclidean distance formula

where p=2 for Euclidean Distance.

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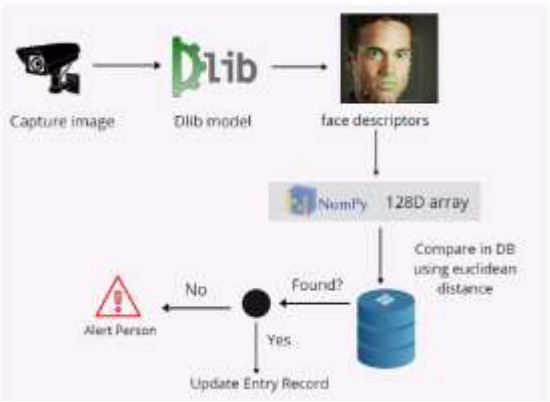

7. If the Euclidean Distance Calculated is the Closest Score to a Face in Database and if it is above a threshold matching Score (0.6 most common), The Face is said to be Found and Recognized.
8. Thus the Entry time and other details are updated and recorded.
9. If there is no matching Face in the Employee Database, it'll be called as an Unknown face and an alert is sent to the Security Personnel at the spot for investigation.
10. The Unknown Person, upon requirement can be Provided a Visitors Pass for a Limited Amount of Time.
11. A Complete Visual Dashboard is provided with complete statistics of employees, including the number of days attended, details on overtime worked etc.

III. IMPLEMENTATION

A. Face Detection

The Core Component of this project is Capturing Faces and recognizing it. This is done Using Python Programming Language. The Face Capturing is Done Using OpenCV which provides a Realtime optimized Computer Vision libraries, tools. Histogram of Oriented Gradients model provided by dlib is used to detect the faces from the frame.

B. Face Recognition

Face Recognition has two main modules one Pose predictor, sometimes the faces we need to recognize are not aligned straight, to tackle that we use pose predictor to get an estimated landmarks of the straight face from the non-aligned face. The second is Encoding Faces and comparison, The Faces are encoded into a 128-dimension array. We use this array to compare with existing face embeddings, using Euclidean distance method. These 128-D array are generated based on Triplet Loss Function.

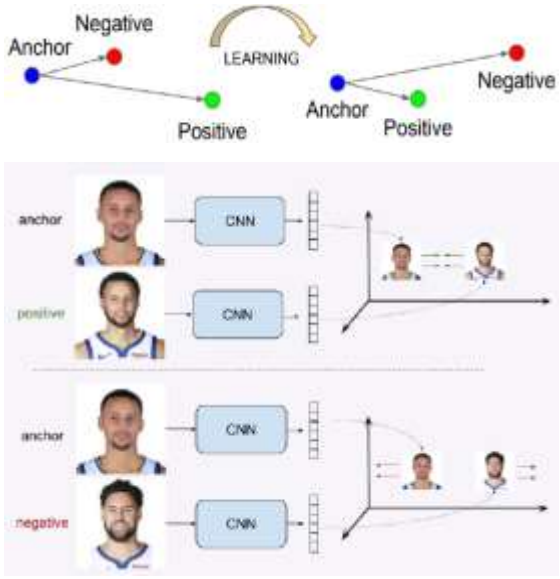

Fig 2. Triplet Loss Function

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C. **Desktop App**

The consumers of our product will be accessing CCTV Cameras and hence Desktop apps are better. Desktop apps are usually the preferred platform for Administrators We will be developing it using the EEL framework. EEL enables python and JavaScript to interact with each other. Suppose if we want to submit a form by clicking a button, the JavaScript can trigger an event and can send the form data to the python by calling python functions, this can be done asynchronously. We can send wide range of data like arrays and objects from JavaScript to python and vice versa. By this method we get the best out of both JavaScript and python i.e., best of the libraries like charts, graphs, animations in which majority of its interactions are directly with user is handheld by JavaScript, on the other hand python handle powerful tools like machine learning, computer vision tools with support of wide range of libraries. EEL creates a platform for end developers to access both JavaScript and python with very less hassle.

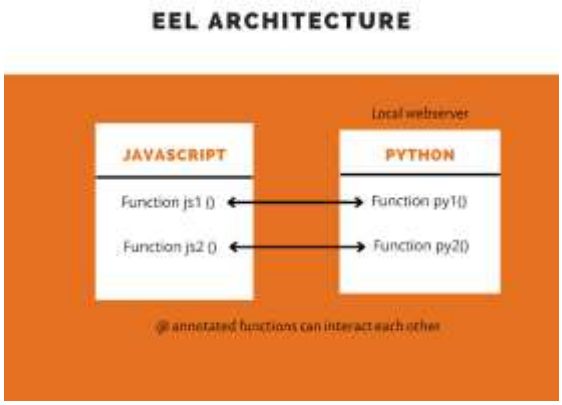

Fig 3. EEL Architecture

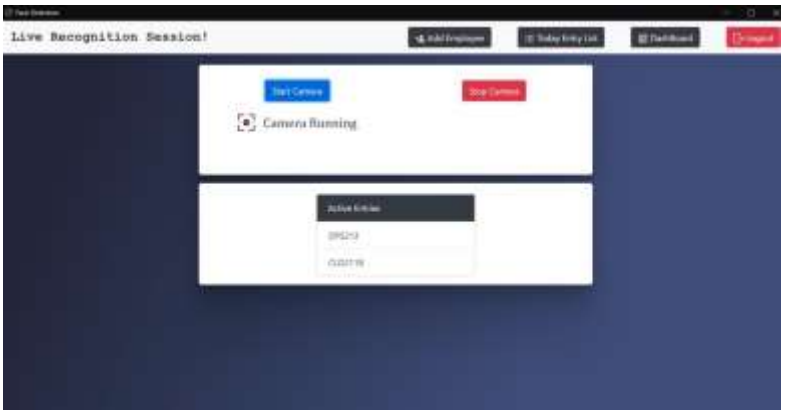

Fig 4. Desktop App

D. **Visualization**

Here we use data visualization to provide attendance details of employees in form of charts and graph. We provide day wise, month wise and also department wise attendance details of the organization. So overall statistics of employee can be easily visualized and understand in a single destination point.

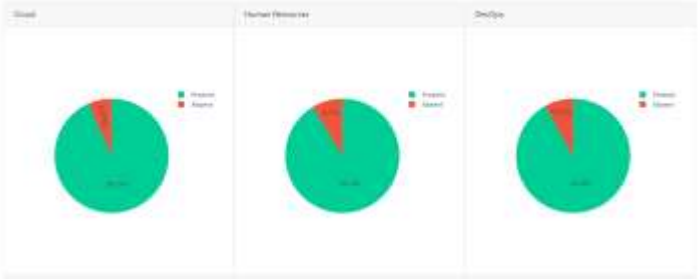

Fig 4. Department wise Analytics

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Fig 5. Overall Statistics

IV. CONCLUSION

This Projects' main aim was to Solve an existing Problem in the Organizations for recording Attendance and its maintenance, Especially Given the Current Times of the Pandemic and Post-Pandemic. Our Objective to Propose a contactless system started with exploring Mechanisms like RFID (Radio Frequency) and Facial Recognition. With the advancements in Artificial Intelligence, Facial Recognition Techniques Have Evolved and Thus Produce Greater Accuracy with efficient Consumption of Resources including Time and Space. We Have Developed a Desktop Application for the User, which is an organization in our case. The Administrator can Access and Start or Stop Camera, add an employee to the database, can see active entries employees whose attendance has been recorded. A complete Dashboard is provided to check the attendance details of the organization. The dashboards show graph of overall statistics and number of employees present each day. One can view the attendance weekly, monthly and current month details. The dashboard also, displays the attendance details of each department, by this we can get to know how each department attendance are and can compare with other departments. The dashboard also allows to check the attendance of an individual by providing the employee id. The employee's attendance details for provided date range will be displayed, details like number of days present and absent of respective employee. The Desktop application is properly structured with database and is ready to use by any organization, with scope for further enhancement.

V. FUTURE ENHANCEMENT

A. **Temporary Pass Feature**: An Unauthorized Person Detected as Unknown can be provided a temporary pass. This will add the person to the database for a limited period of time for recognition and can be deleted after Expiry.

B. **Scalability**: The Database currently has about 100 Employee Data. This can be Scaled to support Higher number of User Data using Certain Big Data techniques.

C. **Additional Dashboard features**: The Dashboard can Be Enhanced by providing additional Features and analytics including integrating it with HR tools. Employee Specific Login Access can be added for personalized experience.

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