PROJECT REPORT
ON

REAL TIME VIDEO BASED ATTENDANCE SYSTEM

A TECHNICAL PROJECT REPORT SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF

Bachelor of Technology
In
ELECTRONICS AND TELECOMMUNICATION ENGINEERING

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CERTIFICATE OF APPROVAL

This is to certify that we have examined the project entitled **"REAL TIME VIDEO BASED ATTENDANCE SYSTEM"** submitted by **BIBIDH BHARDWAJ** Regd. No.- 2001105365, **ABHIJEET PARIDA** Regd. No.- 2001105352, **ANSHUMAN DASH** Regd. No.- 2121105053 of IGIT, Sarang. We here by accord our approval of it as a project work carried out and presented in a manner required for its acceptance for the partial fulfillment for the Bachelor Degree of Technology in Electronics & Telecommunication Engineering for which it has been submitted. This approval does not necessarily endorse or accept every statement made, opinion expressed or conclusions drawn as recorded in this project, it only signifies the acceptance of the project for the purpose it has been submitted.

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ABSTRACT

With the advent of the era of big data in the world and the commercial value of face recognition technology, the prospects for face recognition technology are very bright and have great market demand. This article aims to design a face recognition attendance system based on real-time video processing. This article mainly sets four directions to consider the problems: the accuracy rate of the face recognition system in the actual check-in, the stability of the face recognition attendance system with real-time video processing, the truancy rate of the face recognition attendance system with real-time video processing and the interface settings of the face recognition attendance system using real-time video processing. By analyzing the situation of these problems, the concept of attendance system based on face recognition technology is proposed, and the research on face recognition attendance system based on real-time video processing is carried out. Experimental data shows that the accuracy rate of the video face recognition system is up to 82%. Compared with the traditional check-in method, the face recognition attendance system can be reduced by about 60%. The rate of skipping classes has greatly reduced the phenomenon of students leaving early and skipping classes. The face recognition time and attendance system with real-time video processing through the above experimental certification can quickly complete the tasks of students in the time and attendance check-in system, get rid of the complex naming phenomenon, greatly improve the efficiency of class, and play an important role in guiding the development of the time and attendance system.

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INTRODUCTION

In this era of Internet explosion, computer technology has involved many areas of people's lives and work. The occasions where people come into contact with computers are gradually expanding. The frequency with which people use computing is also increasing. One of the most challenging projects in the field has a broad application prospect because of its huge sense of innovation. As an important identity label for people to distinguish different individuals, face recognition technology has gradually entered people's lives. Face recognition is the combination of artificial intelligence and computer. Because of its huge challenging innovation and broad application prospects, it has become the most challenging topic in this field.

Attendance plays an important role in any organization whether it be educational institutions or companies. So it is very important to keep record of the attendance. The problem arises when one has to manually take the attendance which is not only time consuming but exhausting as well. So an automatic attendance system can solve such problem. Basically, there are two kinds of system: 1) Manual Attendance System (MAS) 2) Automated Attendance System (AAS) One of AAS system is biometric technique using finger prints, though it is automatic and a step ahead of traditional method it fails to meet the time and hygiene constraint. But using the biometric features of face solves such problem.[1]Our projects emphasizes on the features of the face like ears, nose etc. We used a method invented in 2005 called Histogram of Oriented Gradients (HOG) for face detection. For identifying the name of person simple linear SVM Classifier is used. All we need to do is train a classifier that can take in the measurements from a new test image and tells which known person is the closest match. The result is the name of person which is used to mark attendance.

PROBLEM STATEMENT AND MOTIVATION

According to the previous attendance management system, the accuracy of the data collected is the biggest issue. This is because the attendance might not be recorded personally by the original person, in another word, the attendance of a particular person can be taken by a third party without the realization of the institution which violates the accuracy of the data. For example, student A is lazy to attend a particular class, so student B helped him/her to sign for the attendance which in fact student A didn't attend the class, but the system overlooked this matter due to no enforcement practiced. Supposing the institution establish an enforcement, it might need to waste a lot of human resource and time which in turn will not be practical at all. Thus, all the recorded attendance in the previous system is not reliable for analysis usage. The second problem of the previous system is where it is too time consuming. Assuming the time taken for a student to sign his/her attendance on a 3-4 paged name list is approximately 1 minute. In 1 hour, only approximately 60 students can sign their attendance which is obviously inefficient and time consuming. The third issue is with the accessibility of those information by the legitimate concerned party. For an example, most of the parents are very concerned to track their child‟s actual whereabouts to ensure their kid really attend the classes in college/school. However in the previous system, there are no ways for the parents to access such information. Therefore, evolution is needed to be done to the previous system to improve efficiency, data accuracy and provides accessibility to the information for those legitimate party.

ABOUT THE PROJECT

Attendance is prime important for both the teacher and student of an educational organization. So it is very important to keep record of the attendance. The problem arises when we think about the traditional process of taking attendance in class room.

Calling name or roll number of the student for attendance is not only a problem of time consumption but also it needs energy. So an automatic attendance system can solve all above problems.

There are some automatic attendances making system which are currently used by much institution. One of such system is biometric technique and RFID system. Although it is automatic and a step ahead of traditional method it fails to meet the time constraint. The student has to wait in queue for giving attendance, which is time taking.

OBJECTIVE

1. To ensures accurate and reliable attendance recording without manual intervention.
2. Students don't have to wait in queue for giving attendance, which is time consuming.
3. To ease the administrative burden associated with traditional attendance methods.
4. There will be no chance of fraudulent attendance marking.
5. To provide real time monitoring of attendance data. This allows for immediate access to attendance records.
6. To implement a system during exam sessions or in other teaching activities where attendance is highly essential.
7. To eliminate classical student identification such as calling name of the student, or checking respective identification cards of the student, which can not only interfere with the ongoing teaching process, but also can be stressful for students during examination sessions.
8. To design an intuitive and user friendly interface for both administrative and end users to interact with the system easily.
9. To verify (one-to-one matching) a presented face image of an unknown individual along with a claim of identity.
10. To identify (one-to-many matching) an image of an unknown individual, determining that person's identity by comparing (possibly after encoding) that image with a database of (possibly encoded) images of known individuals.

LITERATURE SURVEY

S. no.	Title, Author	Features	Benefits	Limitations
1.	Automated attendance management system using face recognition, Alex L.	Use Eigen faces for Recognition	High accuracy	Multiple faces were not recognized.
2.	Face recognition attendance system by nevon, Peyard,F.,Lab.deRech	Stores the faces that are detected and automatically marks attendance	Used for security purposes in organizations	Don't recognize properly in poor light.
3.	Smart Attendance System using OPENCV based on Facial Recognition, Lixiang Li, Xiaohui Mu, Siyin Li	Takes pictures through the webcam and create a dataset for users using m images. Takes real-time images and mark attendance	Used for marking attendance in schools and colleges.	Cannot mark attendance of the student on a remote sever database.
4.	Smart Attendance Management System Using Face Recognition, Panditpautra V, Goswami A, Khavare A	Student Registration Face Recognition Addition of subject with their corresponding time. Attendance sheet generation and import to Excel (xlsx) format.	In this the data is stored in sorted manner so that it can easily accessible	Require d high definition camera
5.	Face Recognition - A Tool for Automated Attendance	Face detection, Pre-processing, Feature extraction, and Classification stages	High accuracy	Camera should be attached at a specific position
6.	Smart Application for AMS Using Face Recognition, Ian Goodfellow, Jean Pouget-Abadie, Mehdi Mirza	Uses CCTV and Android mobile	3D face recognition algorithm is used	Android phone is expensive and detect one face at time
7.	Student Attendance System in Classroom Using Face Recognition Technique, David M.	Use of Discrete Wavelet Transform and Discrete Cosine Transform.	Multiple face detection was possible	Success rate is only 82%

LIBRARY USED

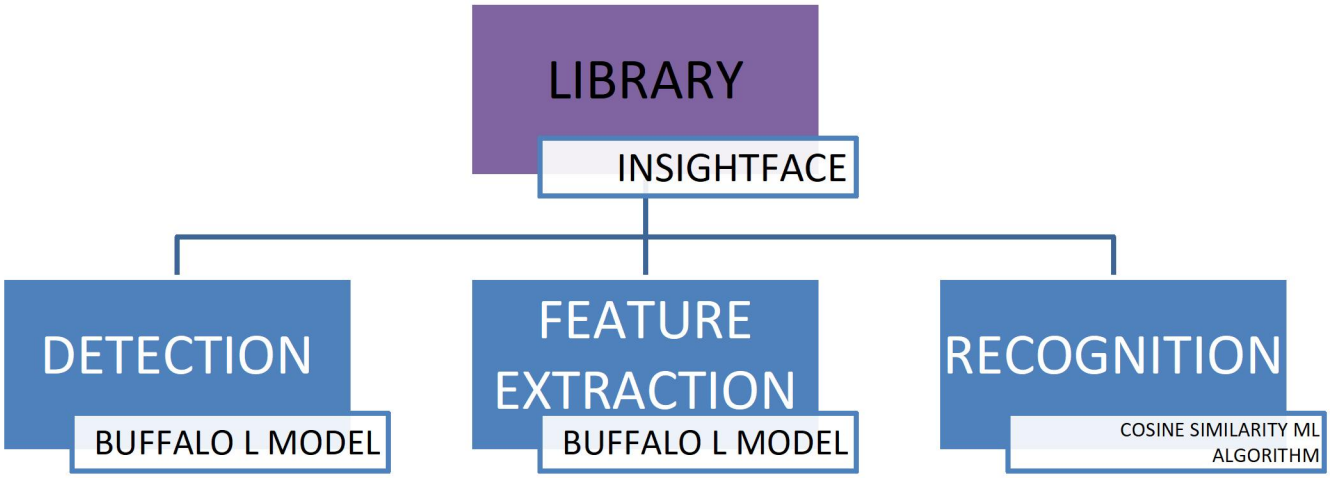

Fig. 1 - Block Diagram Representing The Libraries Used.

1. **InsightFace** : InsightFace is an open source 2D&3D deep face analysis toolbox, mainly based on PyTorch and MXNet.

2. **Buffalo L Model** : This model is used in our system for face detection task and also for extracting facial features from the face. The different types of features that can be extracted from the face are :

   Distance between the eyes
   Distance from the forehead to the chin
   Depth of the eye sockets
   Shape of the cheekbones
   Contour of the lips, ears and chin

3. **Cosine Similarity ML Algorithm** : Cosine similarity is the cosine of the angle between two vectors and it is used as a distance evaluation metric between two points in the plane. The cosine similarity measure operates entirely on the cosine principles where with the increase in distance the similarity of data points reduces. Cosine similarity is used as a metric in different machine learning algorithms like the KNN for determining the distance between the neighbors, in recommendation systems, it is used to recommend movies with the same similarities and for textual data, it is used to find the similarity of texts in the document.

SOFTWARE REQUIREMENT

- **VS Code** - Visual Studio Code, also commonly referred to as VS Code,[12] is a source-code editor developed by Microsoft for Windows, Linux and macOS. Features include support for debugging, syntax highlighting, intelligent code completion, snippets, code refactoring, and embedded Git. Users can change the theme, keyboard shortcuts, preferences, and install extensions that add functionality. It's not, mostly because Visual Studio Code can be configured to be quite close to an IDE for many programming languages. However, along with this configurability come a number of trade-offs. For example, if your development style is test-driven, Visual Studio will work right out of the box. It has a vast ecosystem that could incorporate several third-party services, such as plugin extensions, more smoothly.VS Code offers IntelliSense, a powerful code-completion feature that provides context-aware suggestions as you type.

- **Redis Database** - Redis offers a fast, in-memory data store to power live streaming use cases. Redis can be used to store metadata about users' profiles and viewing histories, authentication information/tokens for millions of users, and manifest files to enable CDNs to stream videos to millions of mobile and desktop users at a time.Redis is an open source, in-memory key-value data structure store, which can be used as a database, cache, or message broker. Redis Enterprise is based on Redis open source and is a NoSQL database but also includes vital functionality to make it enterprise-hardened, with the inclusion of Redis support.

- **Streamlit** - Streamlit is an open-source Python library that makes it easy to create and share beautiful, custom web apps for machine learning and data science. Streamlit is an open-source framework for rapid prototyping and the creation of visualizations and dashboards in Python without the need for knowledge of front-end technologies such as JS or HTML. Streamlit turns data scripts into shareable web apps in minutes. All in pure Python. No front- end experience required. Try Streamlit now Deploy on Community Cloud.

(Logo Images of VS Code, Redis Database and Streamlit Application respectively)

DESIGN AND IMPLEMENTATION

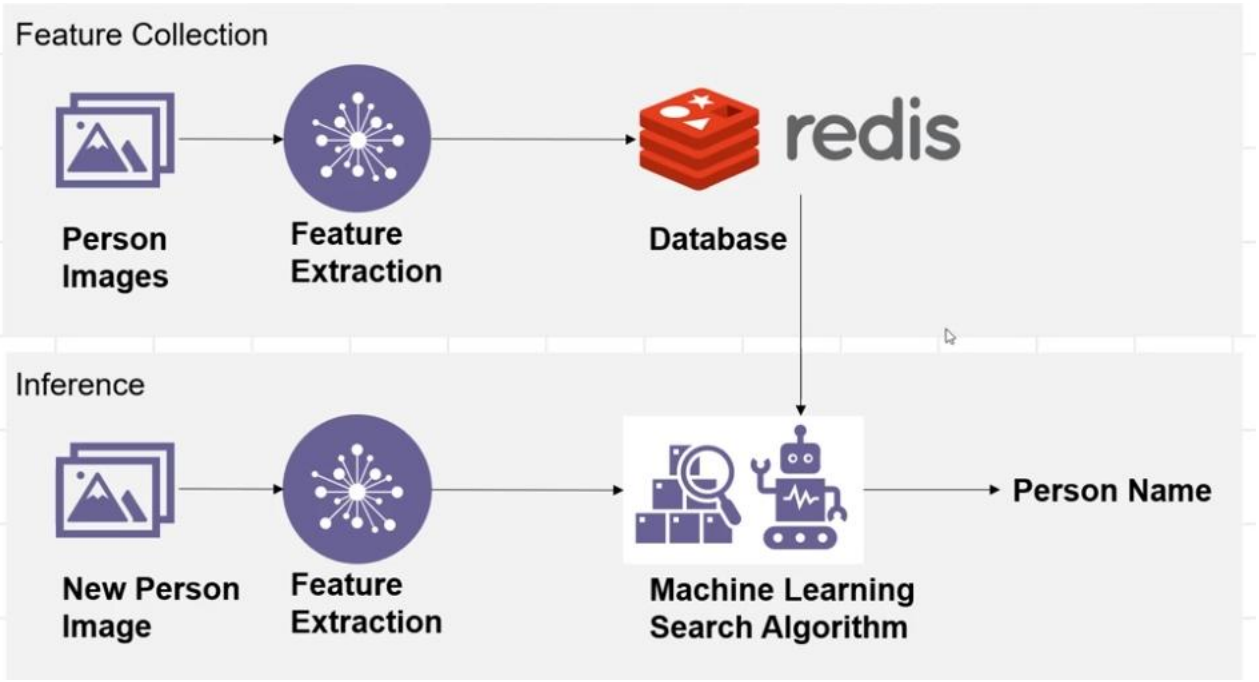

Fig. 2 - Block Diagram of Designing The Attendance System.

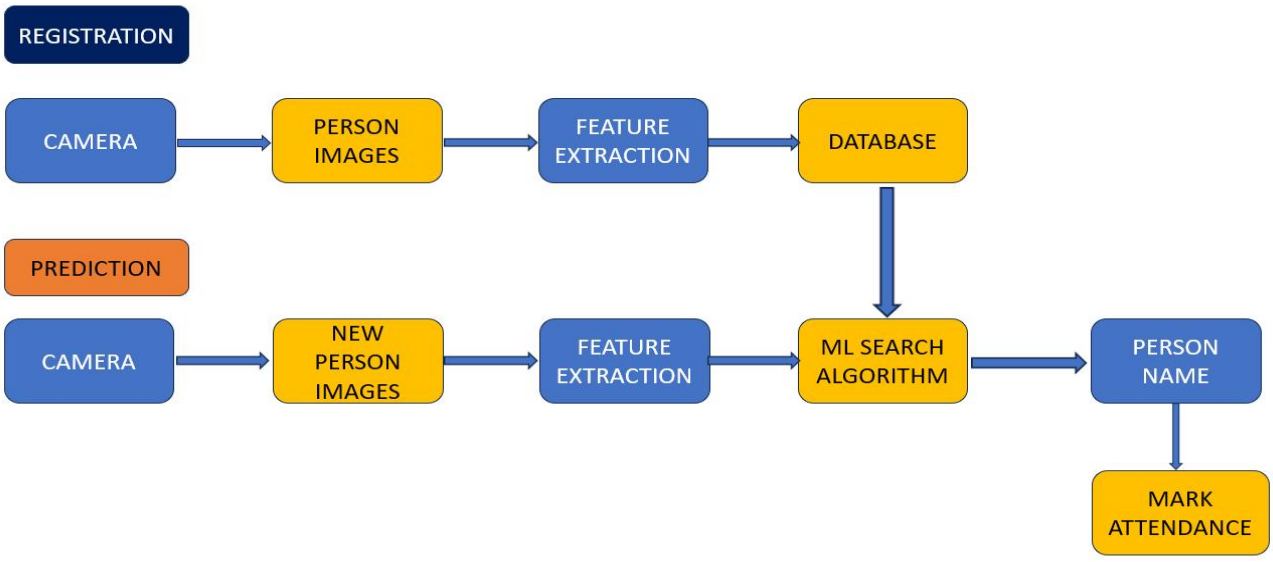

Fig. 3 - Block Diagram Describing Implementation of the entire Attendance System.

STEPS FOR IMPLEMENTATION

1. Open VS code app and go to terminal of the app
2. Write the code to activate the virtual environment. Then change the directory to the folder where project files are present.
3. Write the code to open Streamlit app. The Streamlit app opens up in the default browser.
4. Click on the home page. This page loads the data. The data includes the ML model and Redis database
5. Go to Real time prediction page. The registered users can mark their attendance from this page by clicking on start.
6. To register new user go to Registration Form page. First enter your details in the required place. Then click on start button to start registering your facial features. After around 100 to 150 samples click on close. Then click on submit button. The user will be registered successfully.
7. In the reports page we can check the registered users and the list of users whose attendance is marked along with the date and time of attendance marked.

SOURCE CODE FOR WORKING

```
import numpy as np
import pandas as pd
import cv2

import redis

# insight face
from insightface.app import FaceAnalysis
from sklearn.metrics import pairwise
# time
import time
from datetime import datetime
import os
import pywhatkit

# Connect to Redis Client
hostname = 'redis-11389.c301.ap-south-1-1.ec2.cloud.redislabs.com'
portnumber = 11389
password = '64HKD8iGpqByUZLzKLFsaJdk9PltWCCY'

r = redis.StrictRedis(host=hostname,
                      port=portnumber,
                      password=password)
```

```
# Retrive data from Redis Database
def retrive_data(name):
    retrive_dict= r.hgetall(name)
    retrive_series = pd.Series(retrive_dict)
    retrive_series = retrive_series.apply(lambda x: np.frombuffer(x,dtype=np.float32))
    index = retrive_series.index
    index = list(map(lambda x: x.decode(),index))
    retrive_series.index = index
    retrive_df = retrive_series.to_frame().reset_index()
    retrive_df.columns = ['name_role','Facial Features']
    retrive_df[['Name','Role','phoneNo']] = retrive_df['name_role'].apply(lambda x:
x.split('@')).apply(pd.Series)
    return retrive_df[['Name','Role','phoneNo','Facial Features']]


# configure face analysis
faceapp = FaceAnalysis(name='buffalo_sc',root='insightface_model', providers =
['CPUExecutionProvider'])
faceapp.prepare(ctx_id = 0, det_size=(640,640), det_thresh = 0.5)

# ML Search Algorithm
def ml_search_algorithm(dataframe,feature_column,test_vector,
                        name_role=['Name','Role','phoneNo'],thresh=0.5):
    """
    cosine similarity base search algorithm
    """




    # step-1: take the dataframe (collection of data)
    dataframe = dataframe.copy()
    # step-2: Index face embedding from the dataframe and convert into array
    X_list = dataframe[feature_column].tolist()
    x = np.asarray(X_list)

    # step-3: cal. cosine similarity
    similar = pairwise.cosine_similarity(x,test_vector.reshape(1,-1))
    similar_arr = np.array(similar).flatten()
    dataframe['cosine'] = similar_arr

    # step-4: filter the data
    data_filter = dataframe.query(f'cosine >= {thresh}')
    if len(data_filter) > 0:
        # step-5: get the person name
        data_filter.reset_index(drop=True,inplace=True)
        argmax = data_filter['cosine'].argmax()
        person_name, person_role,person_phoneNo = data_filter.loc[argmax][name_role]
```

```
else:
        person_name = 'Unknown'
        person_role = 'Unknown'
        person_phoneNo='Unknown'
    return person_name, person_role,person_phoneNo
### real Time Prediction
# we need to save logs for every 1 mins
class RealTimePred:
    def __init__(self):
        self.logs = dict(name=[],role=[],current_time=[])

    def reset_dict(self):
        self.logs = dict(name=[],role=[],current_time=[])
    def saveLogs_redis(self):
        # step-1: create a logs dataframe
        dataframe = pd.DataFrame(self.logs)
        # step-2: drop the duplicate information (distinct name)
        dataframe.drop_duplicates('name',inplace=True)
        # step-3: push data to redis database
        #encode the data
        name_list = dataframe['name'].tolist()
        role_list = dataframe['role'].tolist()
        ctime_list = dataframe['current_time'].tolist()
        encoded_data = []
        for name,role,ctime in zip(name_list, role_list, ctime_list):
            if name != 'Unknown':
                concat_string = f"{name}@{role}@{ctime}"
                encoded_data.append(concat_string)

        if len(encoded_data) > 0:
            r.lpush('attendance:logs',*encoded_data)




self.reset_dict()

 def face_prediction(self,test_image, dataframe,feature_column,
                     name_role=['Name','Role','phoneNo'],thresh=0.5):
        # step-0: find the time
        current_time = str(datetime.now())
        # step-1: take the test image and apply to insight face
        results = faceapp.get(test_image)
        test_copy = test_image.copy()
        # step-2: use for loop and extract each embedding and pass to ml_search_algorithm

        for res in results:
            x1, y1, x2, y2 = res['bbox'].astype(int)
            embeddings = res['embedding']
            person_name, person_role , person_phoneNo = ml_search_algorithm(dataframe,
```

```
                                    feature_column,


                                     test_vector=embeddings,
                                         name_role=name_role,
                                         thresh=thresh)
            if person_name == 'Unknown':
               color =(0,0,255) # bgr
            else:
               color = (0,255,0)


            cv2.rectangle(test_copy,(x1,y1),(x2,y2),color)

            text_gen = person_name
            text_phone= person_phoneNo
            cv2.putText(test_copy,text_gen,(x1,y1),cv2.FONT_HERSHEY_DUPLEX,0.7,color,2)
            cv2.putText(test_copy,current_time,(x1,y2+10),cv2.FONT_HERSHEY_DUPLEX,0.7,color,2)
            cv2.putText(test_copy,text_phone,(x1,y2+25),cv2.FONT_HERSHEY_DUPLEX,0.7,color,2)
            view=datetime.now()
            #pywhatkit.sendwhatmsg(text_phone,'Attendance Marked',view.hour,view.minute+1)
            # save info in logs dict
            self.logs['name'].append(person_name)
            self.logs['role'].append(person_role)
            self.logs['current_time'].append(current_time)
         return test_copy

### Registration Form
class RegistrationForm:
    def __init__(self):
        self.sample = 0
    def reset(self):
        self.sample = 0







  def get_embedding(self,frame):
        # get results from insightface model
        results = faceapp.get(frame,max_num=1)
        for res in results:
            self.sample += 1
            x1, y1, x2, y2 = res['bbox'].astype(int)
            cv2.rectangle(frame, (x1,y1), (x2,y2), (0,255,0),1)
            # put text samples info
            text = f"samples = {self.sample}"
            cv2.putText(frame,text,(x1,y1),cv2.FONT_HERSHEY_DUPLEX,0.6,(255,255,0),2)
```

```
# facial features
        embeddings = res['embedding']

    return frame, embeddings
  def save_data_in_redis_db(self,name,role,phoneNo):
    # validation name
    if name is not None:
      if name.strip() != '':
        key = f'{name}@{role}@{phoneNo}'
      else:
        return 'name_false'
    else:
      return 'name_false'

    # if face_embedding.txt exists
    if 'face_embedding.txt' not in os.listdir():
      return 'file_false'

    # step 1: load "face embedding.txt"
    x_array = np.loadtxt('face_embedding.txt',dtype=np.float32) # flatten array

    # step-2: convert into array (proper shape)
    received_samples = int(x_array.size/512)
    x_array =x_array.reshape(received_samples,512)
    x_array = np.asarray(x_array)

    # step-3: cal. mean embeddings
    x_mean = x_array.mean(axis=0)
    x_mean = x_mean.astype(np.float32)
    x_mean_bytes = x_mean.tobytes()

    # step-4: save this into redis database
    # redis hashes
    r.hset(name='academy:register',key=key,value=x_mean_bytes)
    os.remove('face_embedding.txt')
    self.reset()

    return True
```

WORKING

A face recognition attendance system works by capturing and analyzing facial features to uniquely identify individuals. Here is a general overview of how such a system typically operates:

1. Enrolment:
  - Initially, individuals need to be enrolled in the system. During enrollment, the system captures facial images of each person.

- These images are then processed to extract unique facial features, such as the distances between eyes, nose, and mouth, as well as other distinguishing characteristics.

2. Feature Extraction:
- The system uses facial recognition algorithms to convert the unique facial features into a mathematical representation, often called a face template or face signature.
- This process involves creating a set of numerical values that represent the person's facial features.

3. Database Storage:
- The face templates generated during enrolment are stored in a database. Each template is associated with the respective individual's identity.

4. Recognition Process:
- When a person attempts to mark attendance, the system captures a live image of their face.
- The captured image is then processed to extract facial features using the same algorithms used during enrolment.

5. Matching:
- The extracted features from the live image are compared with the stored face templates in the database.
- The system looks for a match by assessing the similarity between the live facial features and the stored templates.

6. Attendance Marking:
- If a match is found, the system recognizes the individual, and attendance is marked for that person.
- The attendance record is then updated, indicating the presence of the recognized individual at that specific time.

7. Feedback and Logging:
- The system may provide feedback to the user, confirming successful recognition or prompting for re-enrolment in case of issues.
- Each attendance event is typically logged, creating a record that can be used for administrative purposes.

8. Continuous Learning and Improvement:
- Some advanced face recognition systems employ machine learning to continuously improve accuracy over time. The system may adapt to changes in facial appearance due to aging, different hairstyles, or other factors.

It's important to note that the effectiveness of a face recognition attendance system depends on factors such as the quality of the captured images, the robustness of the facial recognition algorithms, and the overall system design. Additionally, privacy and ethical considerations should be taken into account when implementing such systems.

ADVANTAGES

Face recognition-based attendance systems offer a plethora of advantages over traditional methods like manual sign-in or ID cards. Here are some key benefits:

1. Improved Accuracy and Reduced Errors.
2. Increased Efficiency and Time Savings.
3. Enhanced Security.
4. Real-time Data and Reporting.
5. Reduced Costs.
6. Contactless Attendance.
7. Integration with Other Systems.
8. Improved Employee Morale.
9. Improved Productivity and Cost Savings.
10. Convenience and ease of use.
11. Hygiene and contactless.
12. Integrations with payroll systems.

APPLICATIONS

Face recognition-based attendance systems are becoming increasingly popular, offering a convenient and secure way to track employee or student presence. Here are some of the key applications of this technology:

1. **Traditional Attendance Tracking:**
- Businesses
- Educational Institutions

2. **Access Control and Security:**
- Restricted Areas
- Events

3. **Time and Attendance Management:**
- Payroll Automation
- Employee Monitoring

4. **Other Applications:**
- Remote Work Verification
- Healthcare
- Retail
- Financial Service

RESULT

The result is obtained for the accuracy of recognition and attendance marking. There- fore, the face recognition attendance system can effectively increase the attendance rate of university classrooms, and is an effective method to restrain students from skipping classes. Many students forget to punch card and they have to suffer for this. But in this system the CCTV will automatically capture the image mark attendance. The efficiency of this system is around 98%.

Fig. 4 - Output Image describing the desired result.

FUTURE SCOPE

1. We can add messaging system to send messages to the parents if the student remains absent.
2. Attendance systems can be seamlessly integrated with HR and Learning Management Systems to streamline overall workforce or student management processes.
3. The face recognition model would be done more precisely so that maximum accuracy can be achieved.
4. This system can be deployed for verification and intrusion detection at various government offices and corporates and also in universities.
5. A system can be designed to capture attendance of entire class at once through CCTV.
6. AI can be used to determine the attentiveness of a student in class.
7. Though there are some weaknesses of facial recognition system, there is a tremendous scope in India. This system can be effectively used in ATM's ,identifying duplicate voters, passport and visa verification, driving license verification, in defense, competitive and other exams, in different sectors.

CONCLUSION

In this approach, a face recognition based automated attendance system is thoroughly described. The proposed approach provides a method to identify the individuals by comparing their input image obtained from image in folder. From this model we can recognize the faces of students and can mark their attendance automatically in real time without human intervention. The feasibility of the model can be increased if a cloud can be hired to store details.

This system aims to build an effective class attendance system using face recognition techniques. The proposed system will be able to mark the attendance via face Id. It will detect faces via webcam and then recognize the faces. After recognition, it will mark the attendance of the recognized student and update the attendance record.

Before the development of this project. There are many loopholes in the process of taking attendance using the old method which caused many troubles to most of the institutions. Therefore, the facial recognition feature embedded in the attendance monitoring system can not only ensure attendance to be taken accurately and also eliminated the flaws in the previous system. By using technology to conquer the defects cannot merely save resources but also reduces human intervention in the whole process by handling all the complicated task to the machine. The only cost to this solution is to have sufficient space in to store all the faces into the database storage. Fortunately, there is such existence of micro SD that can compensate with the volume of the data. In this project, the face database is successfully built. Apart from that, the face recognizing system is also working well. At the end, the system not only resolve troubles that exist in the old model but also provide convenience to the user to access the information collected by mailing the attendance sheet to the respected faculty.

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