A

PROJECT REPORT ON

FACIAL RECOGNITION ATTENDANCE MANAGER

**SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENT OF
THE DEGREE OF BACHELOR OF TECHNOLOGY
IN
INFORMATION TECHNOLOGY
BY**

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UNDER THE SUPERVISION OF
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**CALCUTTA INSTITUTE OF ENGINEERING AND MANAGEMENT
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MAY 2023

<u>CERTIFICATE OF APPROVAL</u>

This project is entitled by "Facial Recognition Attendance Manager" prepared by **Abir Bhattacharya, Arkamitra Mukherjee, Padma Chhatait, Anusweta Das and Basudhara Mitra** is approved and certified for the degree of "**Bachelor of Technology**" in "**Information Technology**" for which it has been submitted.

(Mr. Samir Biswas)
Head of the Department
Information Technology
Date:

(Mrs. Tuhina Sinha)
Assistant Professor
Information Technology
Date:

Date:

Certificate

It is Certified that the work contained in the project titled "Facial Recognition Attendance Manager" by Abir Bhattacharya, Arkamitra Mukherjee, Padma Chhatait, Anusweta Das and Basudhara Mitra has been carried out under my supervision and that this work has not been submitted elsewhere for a degree.

Signature of Supervisor(s)
Name: Mrs. Tuhina Sinha
Department of Information Technology
Calcutta Institute of Engineering and Management
Date:

Declaration

We hereby declare that the project work being presented in the project proposal entitled "Facial Recognition Attendance Manager" in partial fulfilment of the requirements for the award of the degree of **Bachelor of Technology in Information Technology** at **Calcutta Institute of Engineering and Management** is an authentic work carried out under the guidance of Ms Tuhina Sinha. The matter embodied in this project work has not been submitted elsewhere for the award of any degree of our knowledge and belief.

Date: 23-10-2022

Name of Students
1. Abir Bhattacharya
2. Arkamitra Mukherjee
3. Padma Chhatait
4. Basudhara Mitra
5. Anusweta Das

Signature of Students

1. _____

2. _____

3. _____

4. _____

5. _____

Date :

Acknowledgement

I am honoured to have the opportunity to express my heartfelt gratitude to all those who have supported me in the successful completion of my final year project on facial recognition attendance management. I would like to begin by expressing my sincerest appreciation to our Project Mentor, Ms Tuhina Sinha, for her invaluable guidance, encouragement, and support throughout the project. Her expertise and insight have been instrumental in helping me navigate through the various challenges and complexities of the project, and I am grateful for their unwavering commitment to my success.

I would also like to extend my deepest appreciation to the faculty members of Calcutta Institute of Engineering and Management for their guidance and support throughout my academic journey. Their teachings have provided me with a strong foundation of knowledge, skills, and values, which have been critical in shaping my perspective and approach to this project.

Finally, I would like to express my appreciation to all those who have contributed to the successful completion of this project, including my classmates, colleagues, and anyone else who has provided support in any form. I am grateful for your invaluable contributions, which have played a significant role in the successful completion of this project. Thank you all for your unwavering support, and I look forward to continued collaboration and learning opportunities in the future.

Contents

Abstract

The attendance system has developed into a clever and effective approach to monitor attendance for a group of people. In the past, maintaining hard copy attendance registers which took time and were prone to mistakes was one of the manual methods used for managing attendance. However, thanks to the technological revolution, attendance management is now more simplified and practical.

Tracking attendance has been made much easier with the development of software tools like Microsoft Excel, Google Sheets, and other spreadsheet programmes. The automatic computations, data validation, and data sorting capabilities of these spreadsheet applications have improved the accuracy and effectiveness of attendance management. Additionally, these software options make it simple to enter, customise, and analyse data, which makes it straightforward for organisations to handle attendance data for a large number of people.

The use of spreadsheet- and database-based attendance systems has replaced manual attendance registers with systems that are more accurate, dependable, and efficient. Automated attendance systems minimise manual data entry and offer real-time access to attendance data, which has decreased administrative costs and increased productivity.

Attendance systems provide benefits to individuals in addition to organisations. For people to register their attendance, examine their attendance history, and get automated notifications, they offer a user-friendly interface. This encourages accountability and gives people the power to own up to their attendance.

Introduction

A facial recognition system is a system which is capable of detecting a human face from a given image or video. It primarily works by detecting facial landmarks on a face and comparing it with the predefined landmarks of an image in the database. [1]

Broadly the Steps of Facial Recognition can be classified into four parts:

1) Representing the Image on a 2D graph: This is the first step of any kind of Image Processing, and so is the case for Facial Recognition.
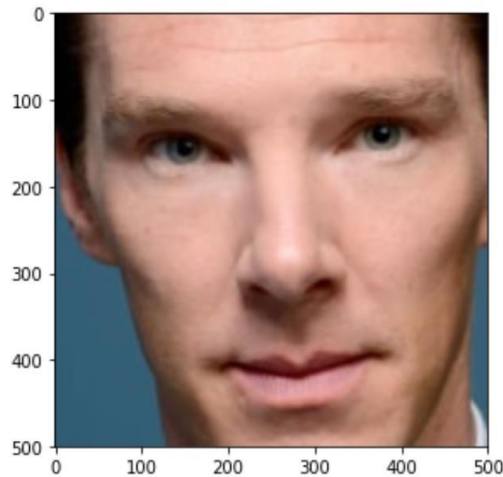

[2] Actual Image

2) Detecting Landmarks: Landmarks are determined by the help of predefined features. In case of a Human Face the features include nose, eyes, lips etc. However identifying these features is completely based on a set of dataset which is containing values in the form of a 2D matrix defining how a human facial feature would generally look like.
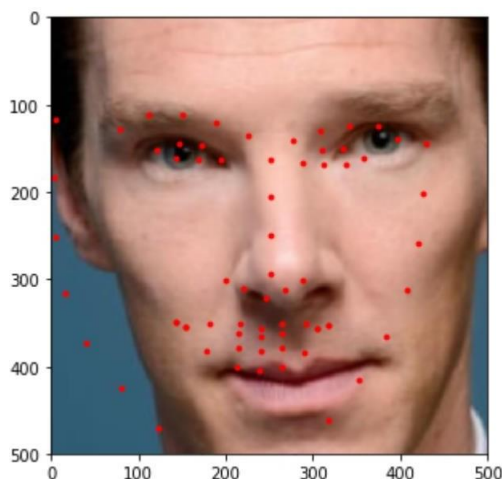
[2] Image with Landmarks

3) Generating Blueprint of Face: The Blueprint of a face is generated by connecting the dots of the landmarks generated in the previous step. This blueprint is unique for each human being except identical twins in some cases.
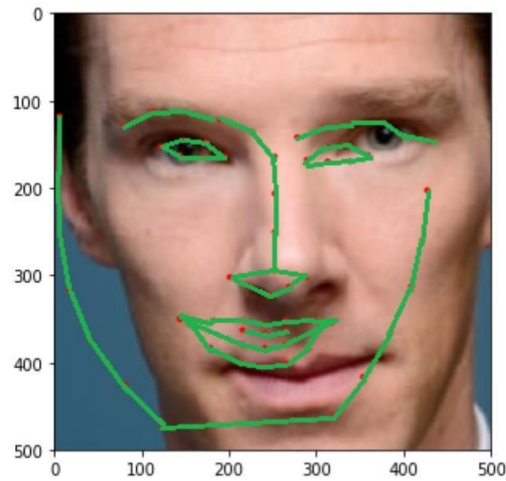
[2] Blueprint of the Image

4) Comparison: The Last step of Facial Recognition is comparing it with an already present blueprint in the database. In this case the generated blueprint will be checked with all the other blueprints in the database and find the closest match possible. Most of the times a matching accuracy of more than 70-80% is the result. Once the blueprints are matched the respective name of the person is the answer to whose face it is.

Aims and Objective

The following are the Aims and Objectives for the project:

1. Login portion for the Teacher who is going to give attendance to students of a particular department.
2. Uploading of the Image of the class taken during the class.
3. Detecting all the faces present in the class.
4. Identifying the student's faces who belong to that class.
5. Submitting the attendance for those student in the database.

Literature Review

Facial recognition is a way of identifying or confirming an individual's identity using their face. It is a category of biometric security. The technology is mostly used for security and law enforcement, though there is increasing interest in other areas of use. The technology is used for a variety of purposes. These include:

1. Unlocking phones

Various phones, including the most recent iPhones, use face recognition to unlock the device. The technology offers a powerful way to protect personal data and ensures that sensitive data remains inaccessible if the phone is stolen. Apple claims that the chance of a random face unlocking your phone is about one in 1 million. [6]

2. Law enforcement

Facial recognition is regularly being used by law enforcement. According to this [7] NBC report, the technology is increasing amongst law enforcement agencies within the US, and the same is true in other countries.

3. Airports and border control

Facial recognition has become a familiar sight at many airports around the world. Increasing numbers of travellers hold biometric passports, which allow them to skip the ordinarily long lines and instead walk through an automated ePassport control to reach the gate faster. Facial recognition not only reduces waiting times but also allows airports to improve security. [8]

4. Banking

Biometric online banking is another benefit of face recognition. Instead of using one-time passwords, customers can authorize transactions by looking at their smartphone or computer. With facial recognition, there are no passwords for hackers to compromise. If hackers steal your photo database, 'live less' detection – a technique used to determine whether the source of a biometric sample is a live human being or a fake representation – should (in theory) prevent them from using it for impersonation purposes. Face recognition could make debit cards and signatures a thing of the past.

Previous works on facial recognition system:

- **Amazon** previously promoted its cloud-based face recognition service named **Rekognition** to law enforcement agencies. [9]
- **Apple** uses facial recognition to help users quickly unlock their phones, log in to apps, and make purchases.
- **British Airways** enables facial recognition for passengers boarding flights from the US. Travellers' faces can be scanned by a camera to have their identity verified to board their plane without showing their passport or boarding pass. [10]
- **Facebook** began using facial recognition in the US in 2010 when it automatically tagged people in photos using its tag suggestions tool. The tool scans a user's face and offers suggestions about who that person is.
- **Google** incorporates the technology into **Google Photos** and uses it to sort pictures and automatically tag them based on the people recognized.
- **Snapchat** is one of the pioneers of facial recognition software: it allows brands and organizations to create filters which mould to the user's face — hence the ubiquitous puppy dog faces and flower crown filters seen on social media.[5]

How Facial Recognition Attendance System is Different from previous works:

- All the previous facial recognition systems were able to recognize one face at a time but this system can recognize multiple faces at a time. User needs to click a picture of a class and using this system each face will be matched from database and if matched that particular student will be marked as present and if any student doesn't belong to that particular class (i.e. checked from database) then it'll also identify that.
- For all the previous facial recognition system a particular software needs to be installed in system but for this no need to install any additional software. It works on any modern browser, one only needs to locally download the repository.

Methodology

Facial Recognition Attendance Management is capable of identifying individual faces from an image including a group of people with different faces. In this way we can generate a list of student present in a class by taking images of the class from 2-3 angles. Once the list of students is generated their attendances can be allotted in a databases by making a POST API call.

For the working of this system no other software is needed to be installed because the entire process can be implemented on a website.

Thus Technologies which will be required for this project are:

1. Mongo DB (For recording student attendances persistently)
2. Node.js (For making the APIs needed for this project)
3. HTML (For frontend scripting of the website)
4. CSS (For styling the frontend)
5. Vanilla JavaScript (For making the API calls)
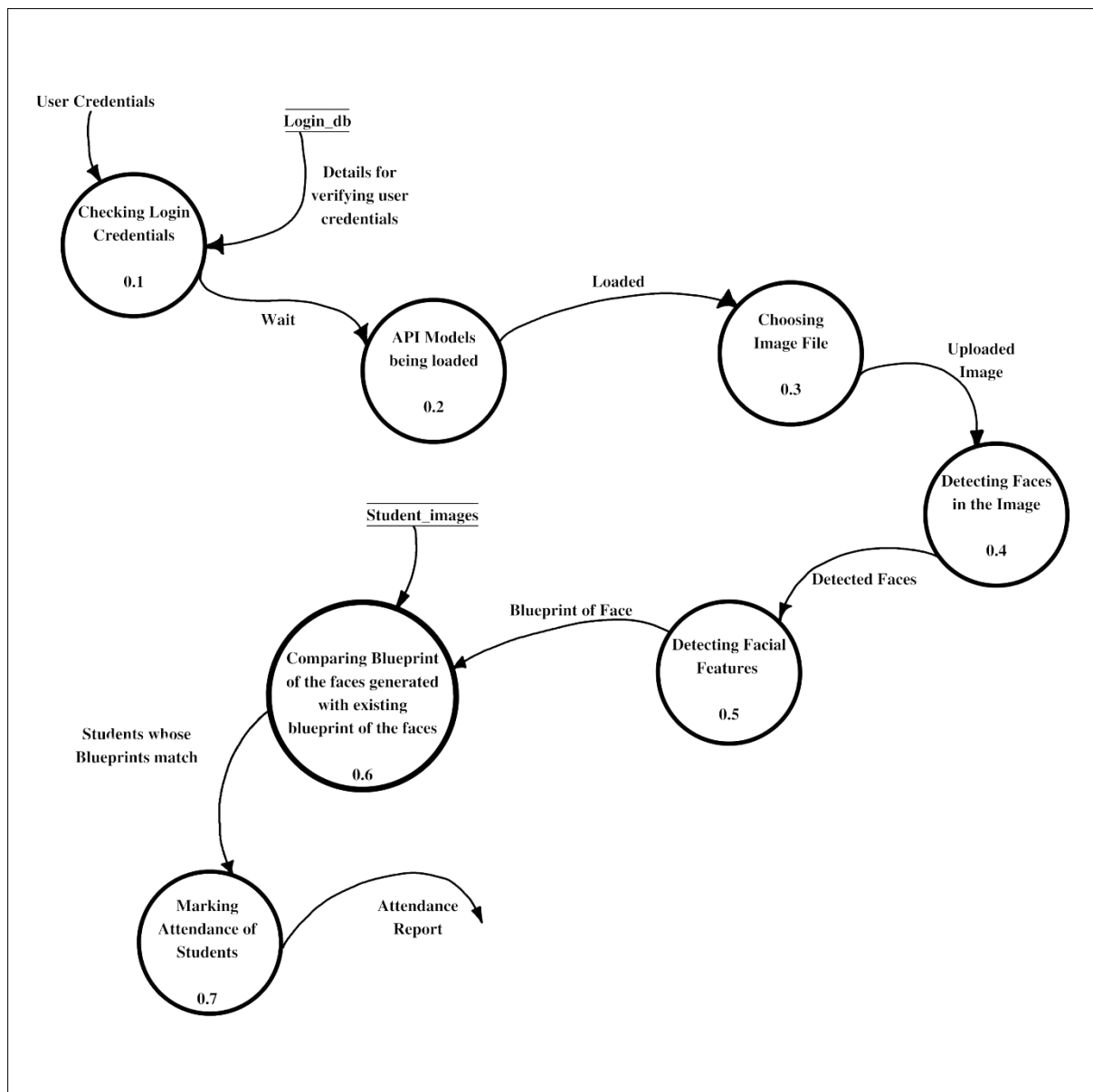
Other open source services used:

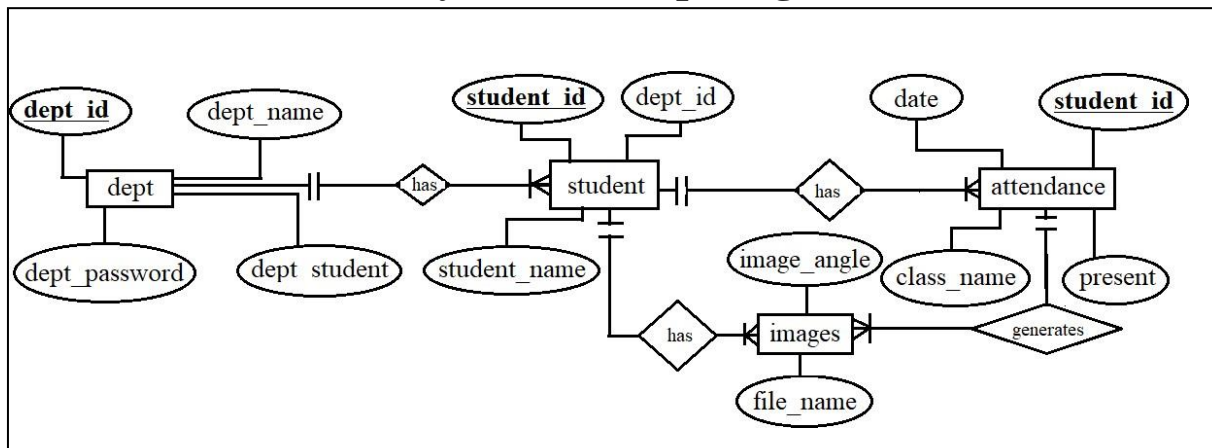1. face-api.js by Vincent Muhler [3]
2. Cloudinary [4]

Data Flow Diagrams

Level Zero:

Teacher

Image of Class

Facial Recognition Attendance Manager

0

Attendance Report

Level One:

User Credentials

Login_db

Details for
verifying user
credentials

Checking Login
Credentials

0.1

Wait

API Models
being loaded

0.2

Loaded

Choosing
Image File

0.3

Uploaded
Image

Detecting Faces
in the Image

0.4

Detected Faces

Student_images

Blueprint of Face

Comparing Blueprint
of the faces generated
with existing
blueprint of the faces

0.6

Detecting Facial
Features

0.5

Students whose
Blueprints match

Marking
Attendance of
Students

0.7

Attendance
Report

Entity Relationship Diagram
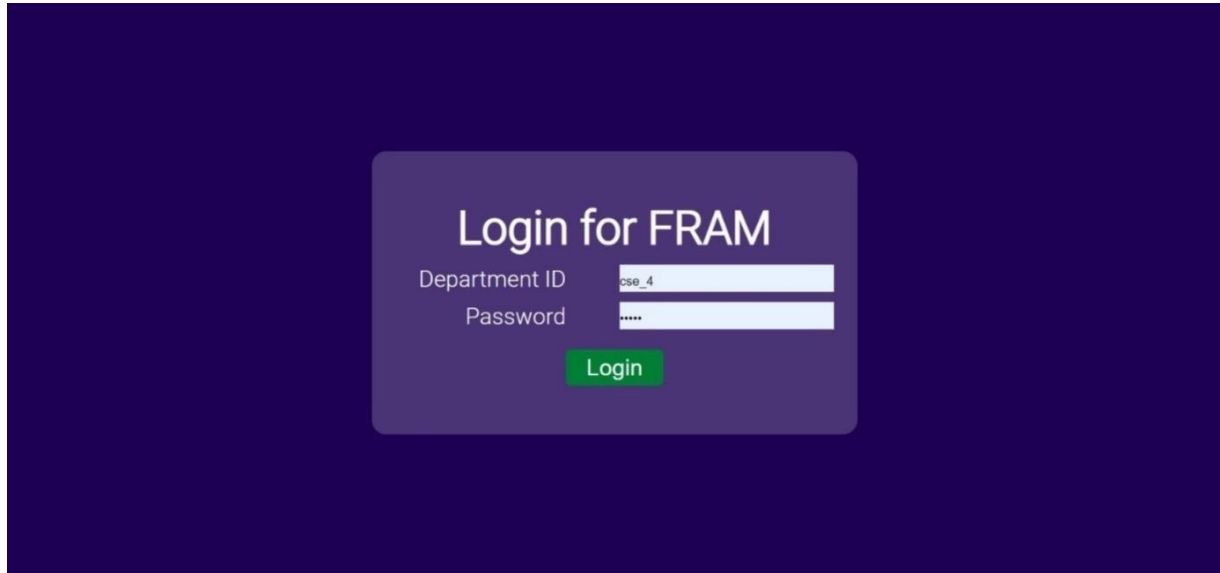
Result and Analysis

1. First teachers have to open our web application. After opening it a "**Loading**" page will beshown. It may take few times to load the models for our application.
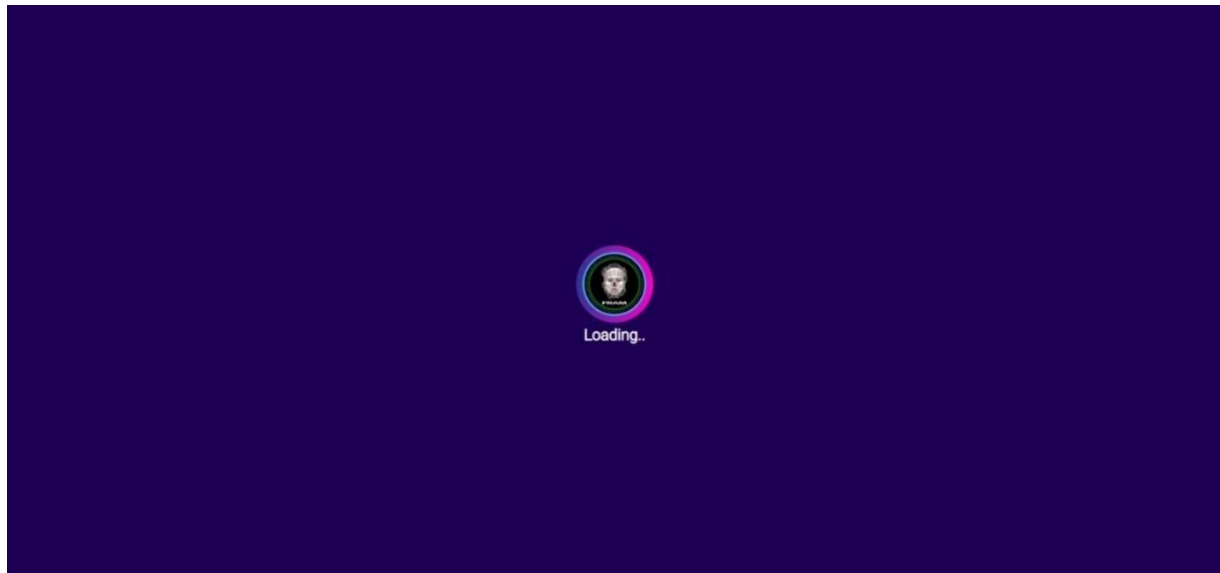
2. After the page is loaded a new page will appear where teachers have to login in ourapplication with the necessary credentials.
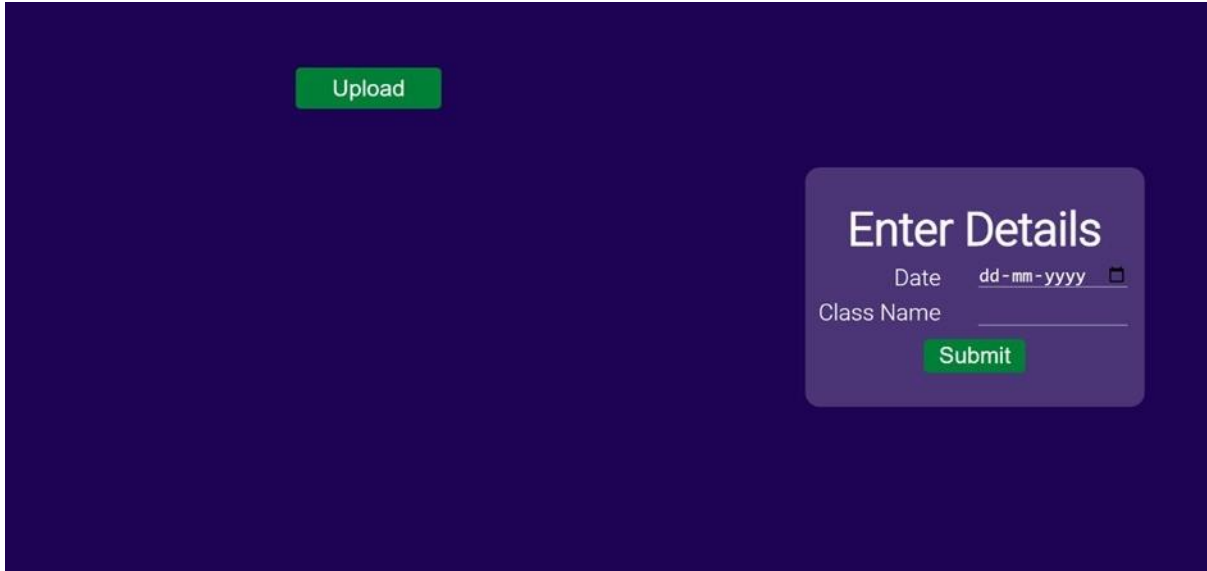

The login credentials are already present in the database. Teachers have to login with that credentials only. If the teacher gives the right Department ID and password then the page will redirect to the next page where teachers can upload the photo of classroom to mark the attendance.

3. If the teachers give wrong Department ID and password then it will redirect to another pagewhere there is a warning that she/he has given the wrong login credentials.
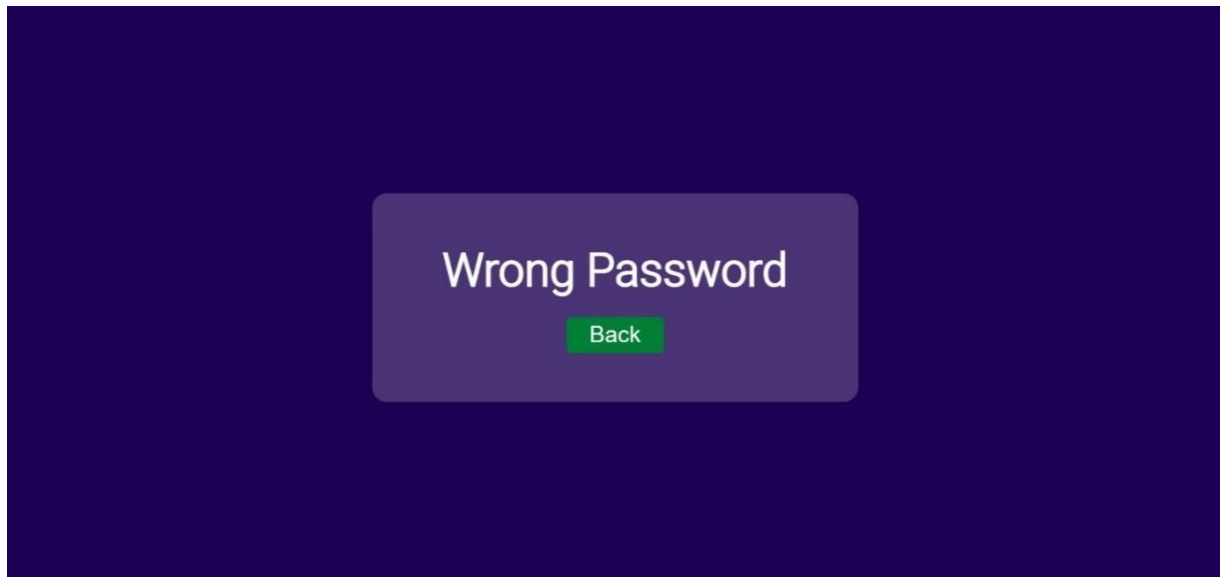
After giving wrong ID and password this above page will appear. Teachers have to click on the back button and it will again redirect to the login page and give the right credentials and go to the upload photo page.
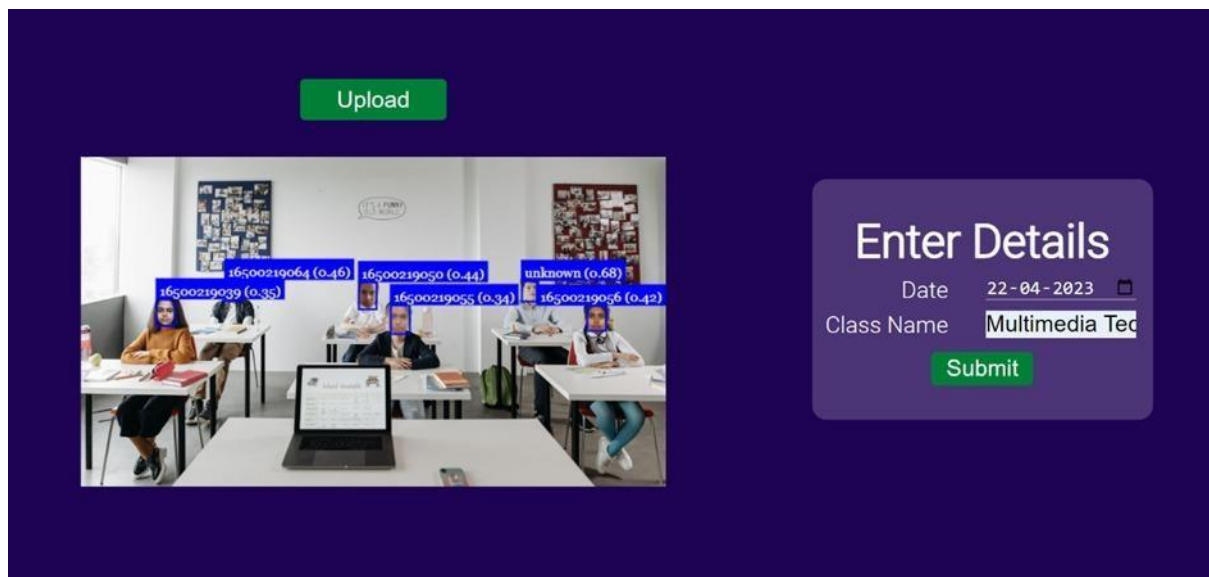
4. After successful log in teacher needs to upload the class image by clicking on the "upload"button.

And the students who belong to that class and present in that image, their face will be identified. Then teacher needs to enter the class name and the date of the class took place.

5. Then teacher needs to click on the "submit" button.

6. If every input field is filled correctly then the attendance will be marked for those students who are present and it will get saved in the database. Then teacher can log out by clicking onthe "log out" button, which will redirect the user back to the home page.

FACIAL RECOGNITION ATTENDANCE MANAGER

Filter ⬚   Type a query: { field: 'value' }   Reset   Apply   More Options ▶

▶   ▶ _id: Object   ✎ 🗐 🗐 🗑
      dept_id: "cse_4"
      student_name: "Basudhara Mitra"
   ▼ attendances: Array
     ▶ 0: Object
     ▶ 1: Object
     ▶ 2: Object
     ▼ 3: Object
         date: "2023-04-22"
         class_name: "Multimedia Technology"
         present: "Y"

Filter ⬚   Type a query: { field: 'value' }   Reset   Apply   More Options ▶

      ▶ _id: Object
      dept_id: "it_4"
      student_name: "Abir Bhattacharya"
   ▼ attendances: Array
     ▶ 0: Object
     ▶ 1: Object
     ▶ 2: Object
     ▶ 3: Object
     ▼ 4: Object
         date: "2023-04-13"
         class_name: "Multimedia Technology"
         present: "N"

INSERT DOCUMENT

Filter ⬚   Type a query: { field: 'value' }   Reset   **Apply**   More Options ▸

```
▸ _id: Object
  dept_id: "cse_4"
  student_name: "Basudhara Mitra"
▾ attendances: Array
  ▾ 0: Object
      date: "2023-04-28"
      class_name: "test class for cse"
      present: "Y"
```

Filter ⬚   Type a query: { field: 'value' }   Reset   **Apply**   More Options ▸

```
▸ _id: Object
  dept_id: "cse_4"
  student_name: "Anusweta Das"
▾ attendances: Array
  ▸ 0: Object
  ▸ 1: Object
  ▾ 2: Object
      date: "2023-04-20"
      class_name: "Multimedia Technology"
      present: "Y"
```

Filter ⊞   Type a query: { field: 'value' }   Reset   Apply   More Options ▶

```
▸ _id: Object
  dept_id: "cse_4"
  student_name: "Anusweta Das"
▾ attendances: Array
  ▸ 0: Object
  ▾ 1: Object
      date: "2023-04-20"
      class_name: "Multimedia Technology"
      present: "Y"
```

Filter ⊞   Type a query: { field: 'value' }   Reset   Apply   More Options ▶

```
▸ _id: Object
  dept_id: "cse_4"
  student_name: "Anusweta Das"
▾ attendances: Array
  ▾ 0: Object
      date: "2023-04-28"
      class_name: "test class for cse"
      present: "Y"
  ▸ 1: Object
```

Filter ⧉   Type a query: { field: 'value' }   Reset   Apply   More Options ▸

```
    student_name: "Padma Chhatait"
  ▾ attendances: Array
    ▸ 0: Object
    ▸ 1: Object
    ▸ 2: Object
    ▸ 3: Object
    ▸ 4: Object
    ▾ 5: Object
        date: "2023-05-04"
        class_name: "Cloud Computing"
        present: "Y"
```

Filter ⧉   Type a query: { field: 'value' }   Reset   Apply   More Options ▸

```
  ▸ _id: Object
    dept_id: "cse_4"
    student_name: "Padma Chhatait"
  ▾ attendances: Array
    ▸ 0: Object
    ▸ 1: Object
    ▾ 2: Object
        date: "2023-04-20"
        class_name: "Multimedia Technology"
        present: "Y"
```

Filter ⧉

Type a query: { field: 'value' }

Reset **Apply** More Options ▸

```
▸ _id: Object
  dept_id: "it_4"
  student_name: "Arkamitra Mukherjee"
▾ attendances: Array
  ▾ 0: Object
      date: "2023-04-20"
      class_name: "AI"
      present: "N"
```

Filter ⧉

Type a query: { field: 'value' }

Reset **Apply** More Options ▸

```
▸ _id: Object
  dept_id: "it_4"
  student_name: "Arkamitra Mukherjee"
▾ attendances: Array
  ▸ 0: Object
  ▾ 1: Object
      date: "2023-06-22"
      class_name: "Multimedia Technology"
      present: "N"
```

Filter ⬈

Type a query: { field: 'value' }

Reset   **Apply**   More Options ▶

▶ _id: Object
  dept_id: "it_4"
  student_name: "Abir Bhattacharya"
▼ attendances: Array
  ▶ 0: Object
  ▼ 1: Object
      date: "2023-06-22"
      class_name: "Multimedia Technology"
      present: "N"
 ▶ 2: Object

Filter⬚

Type a query: { field: 'value' }

Reset   **Apply**   More Options ▸

```
▸ _id: Object
  dept_id: "it_4"
  student_name: "Abir Bhattacharya"
▾ attendances: Array
  ▾ 0: Object
      date: "2023-04-20"
      class_name: "AI"
      present: "Y"
  ▸ 1: Object
```

These are the database snapshots where the respective student's attendance is marked.

If the teacher doesn't enter either of the class date or subject name then an error message will be shown to them.
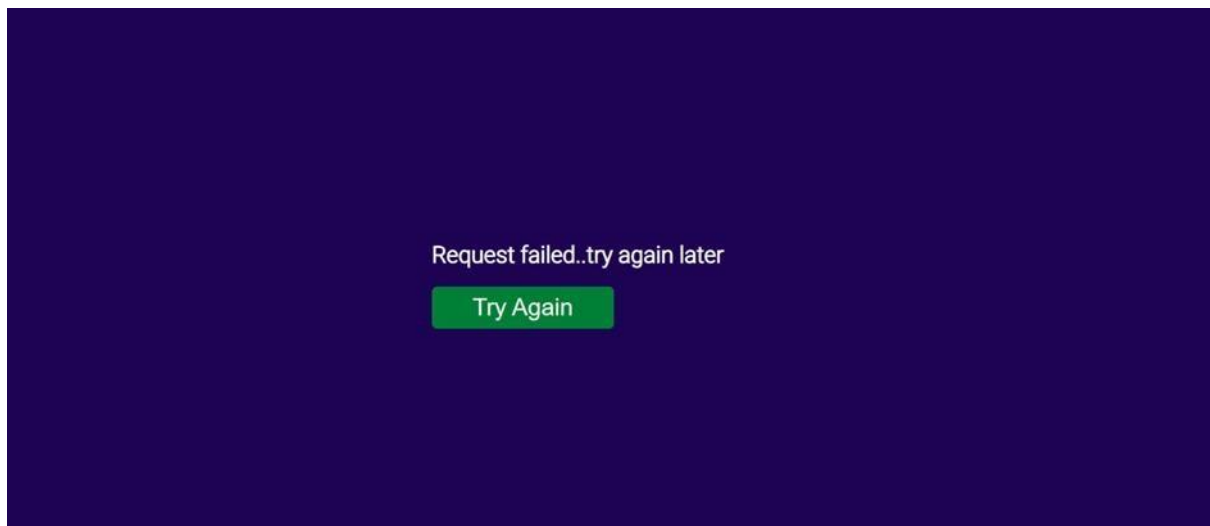
Teacher needs to click on the "Try Again" button to get back to the upload page to enter the details correctly.

Discussion

All existing attendance systems that use Face Recognition techniques have one thing in common which is to detect faces individually and mark their attendances. Howeverthat process is time consuming as it leads to students standing in a queue generally forgetting attendance and takes away time from their classes. Our system captures the entire class in a single snap and allots attendances thus it is not time consuming.

In normal attendance system which is followed in most classes, a teacher marks attendances on pen and paper which takes 10 - 15 minutes from a class. Our attendance system will require just a minute to click an image of the entire class.

The entire process is created with safety in mind where a teacher can upload attendances by accessing this portal through a certain IP Address which is one of the department's faculty computer or any other such administrative computers. As a resultof which if someone gets their hands on the credentials they still can't upload attendances.

It is a common practices in many classes where a student's attendance is marked eventhough that student isn't present when some other individual says "Yes Ma'am" or "Present Ma'am" when that absent student's name is called. Such kind of malpractices can't be done in our Attendance System.

We currently went with the 5 angle approach, where an individual's face is captured from 5 different angles. Thus there is there is no dataset images present where an individual's face might not get detected when he or she is wearing a hat, sunglasses or have beards.

Conclusion

Face recognition is an emerging technology that can provide many benefits. This application is completely based on web therefore no installation is required separately on the computer. Unlike other systems which require installation of the software in the local computer.

Our Facial Recognition Attendance Manager will help the teachers to save their time. On average a professor would take 10 minutes for taking attendance. That would mean 5 minutes of less study in a class. If there are 4 subjects taught in a day that would mean approximately 40 minutes in a day wasted. Compared to our system which would take much less time for completion of taking attendance of the entire class.

Other System available in the market would detect one face at a time and register their attendance. Our system is going to take an image of the entire class and save the time.

Thus our system is a unique and easy to use and fast way of collecting attendances.

Future Scope

The following are the future scopes related to this project

1. Using of more face recognition algorithms for getting more accurate results.
2. Using of 8 angle face detection approach so that we can detect faces even if someone is having a beard, hat or sunglasses.
3. Encrypting the credentials.

Appendix

Image Dataset

The database consists of five sets of images each having five sample images. The five sets of images are of five people and the five samples are images of different sides of each face. The sides are front, left, right, front-left and front-right. The images are sourced manually. All images are in RGB colour-space and stored in the JPEG format.

padma_1[11]

padma_2[12]

padma_3[13]

padma_4[14]

padma_5[15]

arkamitra_1[16]

arkamitra_2[17]

arkamitra_3[18]

arkamitra_4[19]

arkamitra_5[20]

anusweta_1[21]

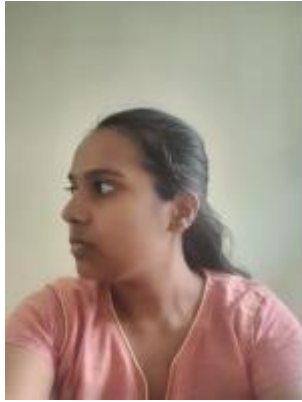anusweta_2[22]

anusweta_3[23]
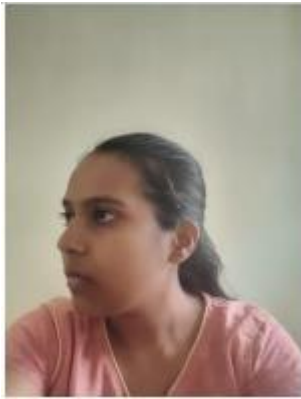
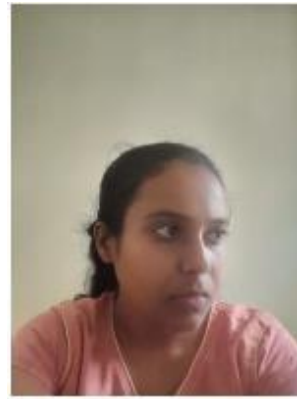

anusweta_4[24]

anusweta_5[25]

basudhara_1[26]

basudhara_2[27]

basudhara_3[28]

basudhara_4[29]

basudhara_5[30]

abir_1[31]

abir_2[32]

abir_3[33]

abir_4[34]

abir_5[35]

References

[1]https://en.wikipedia.org/wiki/Facial_recognition_system

[2]https://medium.com/ml-everything/how-facial-recognition-works-part-2-faciallandmarks-72f1b0e2a33a

[3]https://justadudewhohacks.github.io/face-api.js/docs/index.html

[4]https://cloudinary.com/

[5]https://www.kaspersky.com/resource-center/definitions/what-is-facial-recognition

[6]https://support.apple.com/en-in/HT208108

[7]http://www.nbcnews.com/news/us-news/how-facial-recognition-became-routine-policingtool-america-n1004251

[8]https://www.kaspersky.com/resource-center/definitions/what-is-facial-recognition

[9]https://docs.aws.amazon.com/rekognition/index.html

[10]https://mediacentre.britishairways.com/pressrelease/details/

[11]https://res.cloudinary.com/dvzh3aj7y/image/upload/v1680198582/LabelledImages/16500219039/1.jpg

[12]https://res.cloudinary.com/dvzh3aj7y/image/upload/v1680198581/LabelledImages/16500219039/5.jpg

[13]https://res.cloudinary.com/dvzh3aj7y/image/upload/v1680198581/LabelledImages/16500219039/2.jpg

[14]https://res.cloudinary.com/dvzh3aj7y/image/upload/v1680198581/LabelledImages/16500219039/3.jpg

[15]https://res.cloudinary.com/dvzh3aj7y/image/upload/v1680198581/LabelledImages/16500219039/4.jpg

[16]https://res.cloudinary.com/dvzh3aj7y/image/upload/v1680197957/LabelledImages/16500219055/4.jpg

[17]https://res.cloudinary.com/dvzh3aj7y/image/upload/v1680197957/LabelledImages/16500219055/3.jpg

[18]https://res.cloudinary.com/dvzh3aj7y/image/upload/v1680197957/LabelledImages/16500219055/1.jpg

[19]https://res.cloudinary.com/dvzh3aj7y/image/upload/v1680197957/LabelledImages/16500219055/2.jpg

[20]https://res.cloudinary.com/dvzh3aj7y/image/upload/v1680197957/LabelledImages/16500219055/5.jpg

[21]https://res.cloudinary.com/dvzh3aj7y/image/upload/v1680197569/LabelledImages/16500219056/4.jpg

[22]https://res.cloudinary.com/dvzh3aj7y/image/upload/v1680197569/LabelledImages/16500219056/1.jpg

[23]https://res.cloudinary.com/dvzh3aj7y/image/upload/v1680197569/LabelledImages/16500219056/2.jpg

[24]https://res.cloudinary.com/dvzh3aj7y/image/upload/v1680197569/LabelledImages/16500219056/5.jpg

[25]https://res.cloudinary.com/dvzh3aj7y/image/upload/v1680197569/LabelledImages/16500219056/3.jpg

[26]https://res.cloudinary.com/dvzh3aj7y/image/upload/v1680163649/LabelledImages/16500219050/1.jpg

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[33]https://res.cloudinary.com/dvzh3aj7y/image/upload/v1680106543/LabelledImages/16500219064/5.jpg

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