Automatic Attendance Maintenance App with Facial Recognition.

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***Abstract* — Attendance management in schools and colleges is becoming a rather time-consuming task with the increase in student strength per class. If you calculate the amount of time taken by each teacher per subject in a year, it adds up to approximately 25-35 hours of extra time taken. The teacher could've used this time wisely instead to teach the actual subject. Another problem that arises by manual attendance management is the misuse of proxies. All these problems can be avoided by the use of a completely automated system. This project is an automated attendance manager by using facial recognition with the help of deep learning and machine learning. It provides real time app updates using google firebase / sockets.**

Keywords— image recognition, facial detection, firebase, react native, android application, web application, deep learning

I. INTRODUCTION

Automated face recognition system plays a very important role in face recognition, head-pose estimation, and human to computer interaction. This project aims to apply a deep learning algorithm to accurately identify the students present in a class by recognizing their faces. This avoids the involvement of the teacher who can now give full focus to the subject without wasting any time. The students will be able to see their attendance calculated per subject in the android app made. Even though this process is completely automated, the flexibility of manual updation of the attendance by the teacher is also provided. This is made into a web app which also has multiple functionalities.

II. RELATED WORK

A. Iris-Recognition Based Attendance System

Iris recognition is technically defined as an automated method of biometric identification that uses mathematical pattern-recognition. It is used on video images of on the irises of an individual's eyes, whose complex patterns are unique, stable, and can be seen from a distance.

B. Fingerprint Based Attendance System

Fingerprint based Attendance System can be implemented using a portable machine, on which students have to place their finger on the machine, and the machine takes note of the student's identity. This is easy, as it doesn't require instructor's interference and ensures that there is no possibility for proxies.

III. SYSTEM STUDY

A. Facial Recognition

1) Tech Stack:

- Python
- OpenCV
- dlib
- Firebase

2) Working:

This program uses the face recognition library to recognize faces. This model has over 99 percent accuracy and has been trained with millions of images and consists of complex convolutional neural networks which are written in C++ and converted back to python to decrease execution time.

Each face from an image is first converted to a 128-dimensional vector representing the face encodings. Each face is represented as a point in Euclidian space with 128 dimensions.

Then when a new face is detected in a frame, it is also converted to a 128-dimensional vector with the face encoding and the distance between these points is calculated by using the Euclidian distance formula for n-dimensions. Let the 2 face encoding vectors be denoted by j^ and k^, the distance between the vectors is given by the following formula.

$$||j\hat{} - k\hat{}|| = ((j_1-k_1)^2 + (j_2-k_2)^2 + ... + (j_n-k_n)^2)^{0.5}$$

The distance and the similarity of the faces is inversely proportional. i.e. The distance between the vectors decreases, the percentage matching of the face increases and vice-versa.

3) Training and Testing:

The student images are first uploaded to the faces folder where each of them is given an encoded value. Then the classroom lecture is put in the script folder as an mp4 file to be processed. OpenCV then extracts frames from the video and predicts the faces present and connects with the firebase database and updates the attendance of the present students for the given subject and date.

4) Result

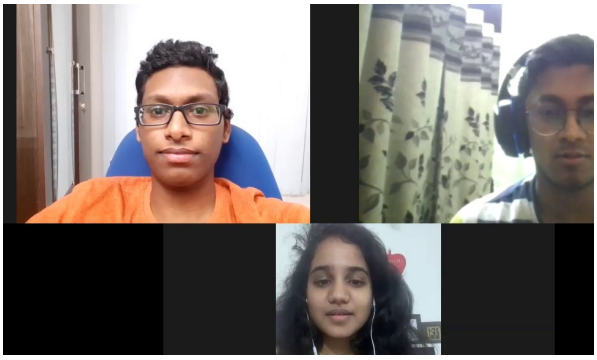

Fig.1a – Before processing video

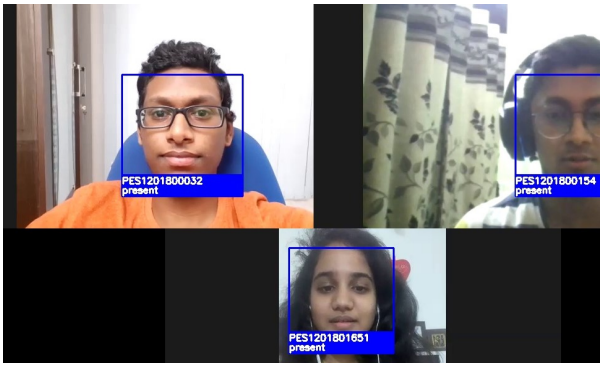

Fig.1b – Program result

A video call was set up to show the program demonstration. As seen from the results, all 3 of the recognized faces are marked as present in the picture as well as in the database.

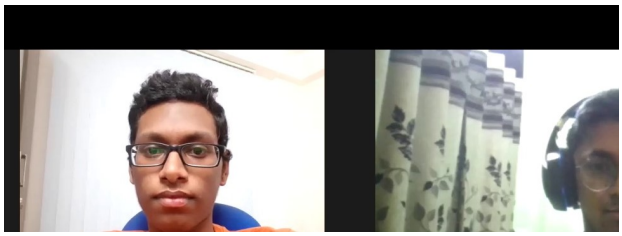

Fig.1c – Before processing video

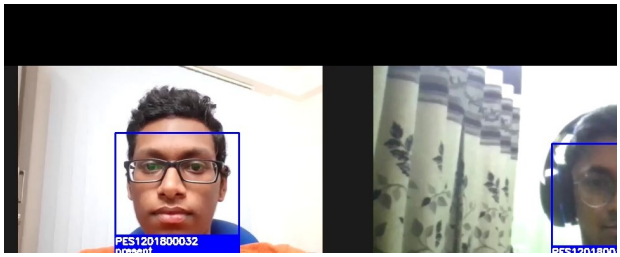

Fig.1d – Program result

When the program was tried with only 2 faces rather than all 3, it gave expected results. Only the faces present in the video were marked as present and the face not in the video was marked as absent.

B. Real Time Database Management

The database required for this product must be working under real-time principles. The database has the flexibility to add new students, subjects, or alter information easily. It is developed with the firebase backend store management.
It stores the data in JSON format (NoSQL).

1) Advantages:

- Database is on the cloud, so it can be accessed via an API call
- Lightweight JSON format for higher transfer speed even on low bandwidth
- Real-time asynchronous database retrieval

C. Android Application

1) Functionality:

- Full functioning login screen with keyboard avoiding view and Safe View.
- Home screen with sticky carousel items.
- Attendance list screen with styled FlatList component.
- Student profile screen with all the details.
- Fetches data stored in firebase database in real-time.
- Uses async-storage-react-native for local storage of user credentials.
- Has pull-to-refresh functionality.
- Calculates the number of classes required to make up for a threshold percentage.
- Opens modal from bottom with smooth 60fps animation for in-depth attendance details class-wise.
- In-app password change feature.

2) *Interface Showcase:*

a) Login Screen:

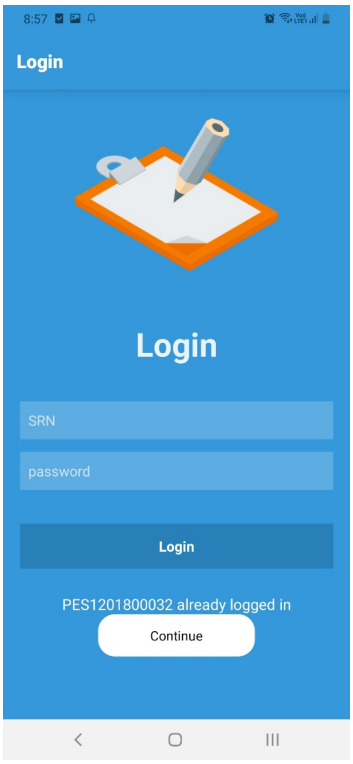

Fig.2a

- User can enter SRN and password to sign in.
- Has an authentication program to check with the database for the user.
- Uses phone local storage to keep the user logged in even after exiting the app.

b) Home Screen:

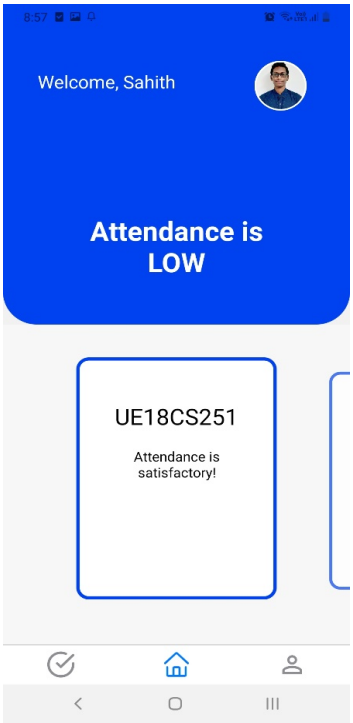

Fig.2b

- Has a bottom tab navigation with 3 tabs.
- Checks if the minimum attendance is above a threshold and displays a message accordingly.
- Has scrollable carousel items for each subject.
- Calculates the number of classes required to clear the cutoff

c) Attendance Screen:

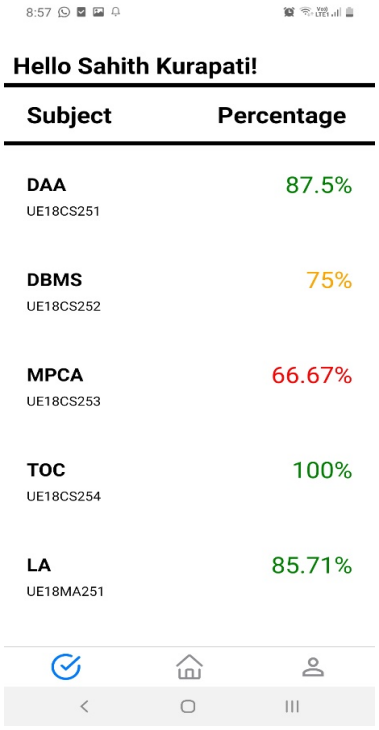

Fig.2c

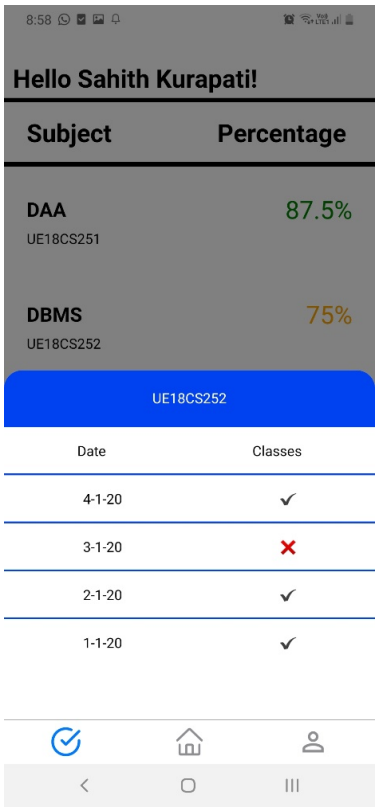

Fig.2d

- Shows attendance for each student, subject wise
- Opens a modal to show a subject's date-wise attendance
- Displays the attendance percentage in green, orange, and red for the respective danger levels of attendance according to the threshold.

d) Profile Page:

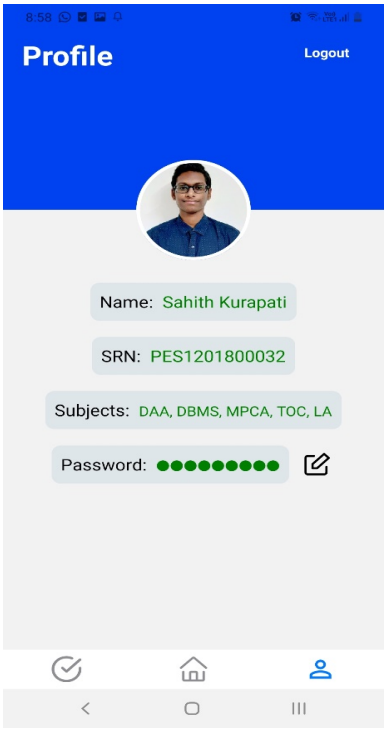

Fig.2e

- Displays the logged in student's profile
- Includes the ability to change the password in the app itself
- Also has the option to logout

D. Web Application

1) Functionality:

- Fully functional login screen that takes teachers credentials as input.
- Easily accessible navigation bar on every page.
- Teacher profile page with all details.
- Fetches data stored in firebase database in real-time.
- Add student option directed to a form taking student details as input. On clicking add button, adds the student information to the firebase database.
- Update attendance option directed to a form where the attendance of the student can be conveniently updated by entering only the SRN.
- View attendance page to view the student details and their attendance.
- Logout option that brings the user back to the login page.

a) Login page:

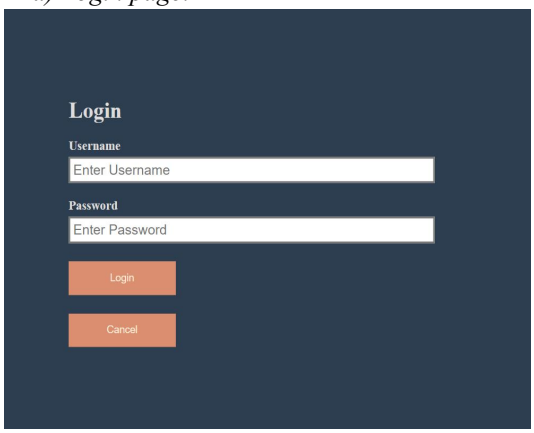

Fig.3a

- Teacher can enter user id and password.
- Either field cannot be left empty.
- Cancel button clears the entered information, in case the user wishes to retype their credentials.

b) Profile Page:

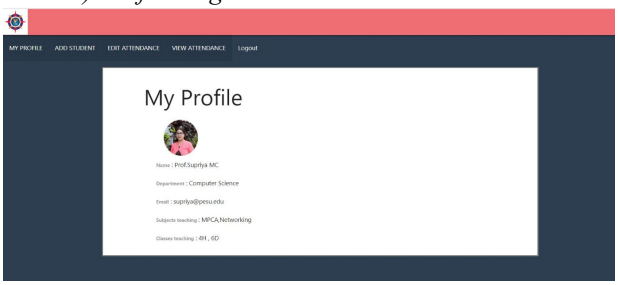

Fig.3b

- Once logged in, it displays the teacher details.
- Displays the picture, Department, email, subjects teaching, and the classes the user teaches.

c) Add students page:

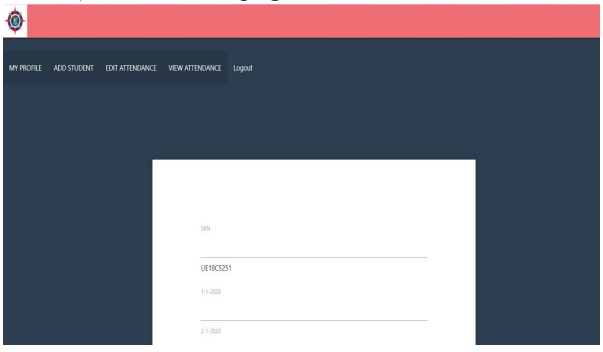

Fig.3c

- This page is in a form format, where the teacher can enter details to add a new student to the database.
- It has several fields like SRN, name, and subjectwise dates, to be filled for the addition of the new student.
- The student information entered in this page, creates a new student on the real time firebase database.

d) Update Page:

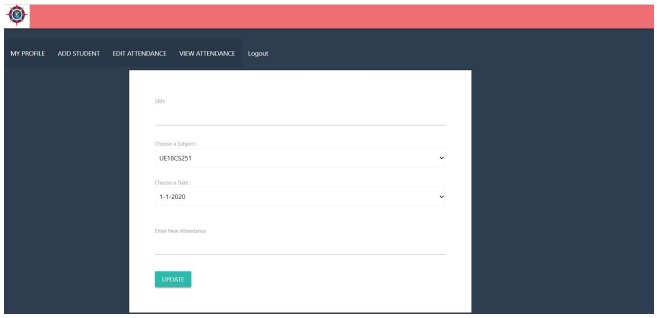

Fig.3d

- Similar to the add page, the update page is also a form, where the SRN is entered to update the particular student's attendance.
- On clicking the update button, the changes are made in the real-time firebase database.

e) View Attendance Page:

Fig.3e

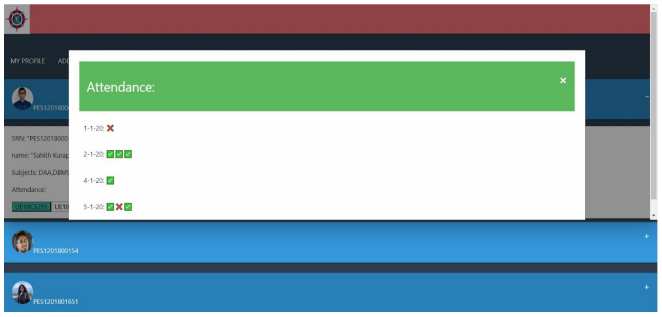

Fig.3f

- The elaborate view page displays the visual representation of the database, with the student details and their attendance.
- It has a drop down for each student, along with an individual pop-up with the attendance for each subject, each day.
- Every time a new student is added, or an existing student's attendance is updated, the change can be seen on this page.

IV. PROCESS OVERVIEW

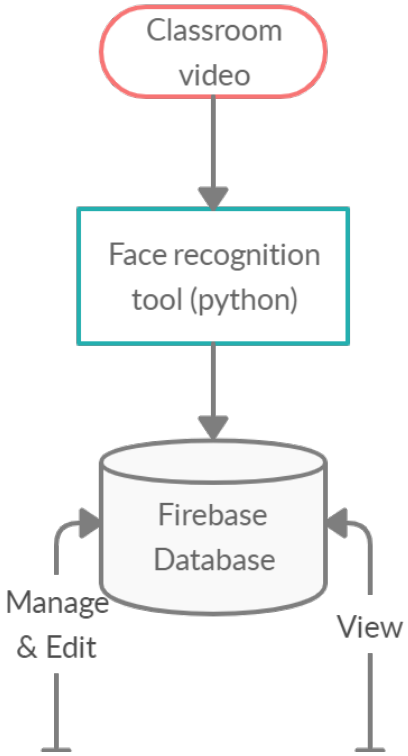

Fig.4a

First, the video recordings of the day are located in a certain folder. Then the python face recognition program extracts specific frames (according to our algorithm implemented) and detects the students in the video. This information is then updated automatically in the firebase database. The students present in the video are marked present with '1' in the database and absent with '0', This binary representation is to reduce the bandwidth required while transferring data to the app, thus increasing the load speed of the android app.

Then the student can check his/her attendance in the android app directly as the information is updated in real-time. The student must login to the app before being able to see the attendance. These login credentials are also stored locally so the student doesn't have to login every time. The student can check out all the attendance information as well as get information as to how many more classes he/she needs to attend to clear the cutoff.

In case of any discrepancy, the teacher can also manually update the attendance in the web app made. The teacher can add new students, update attendance, and view each student's attendance separately etc. This is the backup option to use in case of any kind of system failures or momentary breakdown. This proves to be useful in cases where the footage of the classroom is not available due to other technical reasons.

V. CHALLENGES OVERCOME

- One of the main difficulties is when a there is a mark or the camera is covered and it does not record all the faces in the video. This project solves that problem by alerting the management when the program notices suspicious activity like camera being covered. Program has a threshold number of faces failing which, it raises an alert and notifies the problem.
- Distance from the camera is another problem that raises concern. The face recognition program resolves this issue to an extent by making use of face encodings in a 128-dimensional vector represented in space. It tries to calculate the most accurate version of the face encodings even when the student is far as long as the video is of high-quality resolution.

VI. PRODUCT SCOPE

- This project has covered all the technical features required to operate in any school/college.
- The product comes as an all-in-one package where almost everything is automated.
- Software package is flexible to work in any environment with easy setup and minimal supervision.
- The product requires the use of HD cameras placed in the classroom of choice to automate.
- Overall, this product has a good scope for the future and has a high demand in the market.

VII. OTHER APPLICATIONS

This project can also be easily extended to the following applications apart from institutions:

- Corporate centers or companies where an attendance system is required. The only change that would be necessary to fit this model, would be to use multiple cameras around the whole office. Then the normal face recognition module can be run as usual. The database and app can be directly applied as they are flexible in user authentication.
- Banks are required to be safe from theft. And this project partially can be applied to prevent robbery by recognizing the faces in a bank at a particular time and comparing with the database of existing customers. If a new face is found, it can be shown to the branch manager and check for any suspicious activity.

CONCLUSIONS

This system is designed for efficiency, scalability and automatability. The whole process was designed and implemented with the main motive to eliminate the disadvantages of the current manual system. Making use of facial recognition algorithms to automate the process of attendance removes the redundancy of time and cost factors.

This project is ready to move to the production stage for real-life implementation in schools, colleges, and universities. The project also uses a versatile model for the execution so it can meet any institutions' requirements easily.

ACKNOWLEDGEMENT

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REFERENCES

[1] Face Detection Techniques: A Review – Anshu Kumar, Punjab University, Patiala.

[2] Image-based Face Detection and Recognition: "State of the Art" Faizan Ahmad1 , Aaima Najam2 and Zeeshan Ahmed3 1 Department of Computer Science & Engineering, Beijing University of Aeronautics & Astronautics Beijing, 100000, China.

[3] The Research of Intelligent Image Recognition Technology Based on Neural Network LI Huanliang1, a 1 Yishui Campus of Linyi University, Yishui 276400,China