DR. B.R. AMBEDKAR NATIONAL INSTITUTE OF TECHNOLOGY JALANDHAR

MINOR PROJECT FOR BTECH 3rd YEAR REPORT ON

ATTENDANCE SYSTEM USING GROUP FACIAL RECOGNITION WITH FEEDBACK

Department of Computer Science and Engineering

Session: 2020-24

MENTORED BY:

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ACKNOWLEDGEMENT

DECLARATION

*We, as members of Group 57, affirm that the project titled "**Attendance System using Group Facial Recognition with Feedback**," submitted to the Department of Computer Science and Engineering, is our original work. This project was conducted under the guidance and supervision of Dr. Somesula Manoj Kumar. We assure that the project has not been plagiarized or copied from any source.*

Date: 13th May, 2023

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20103132   *20103048*

In the event of any plagiarism being discovered, we take full responsibility for it.

Thank You All.

Signature of Supervisor
Dr. Somesula Manoj Kumar
Assistant Professor
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NIT Jalandhar

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Submission date:	12-May-2023 04:34PM (UTC-0700)
Submission ID:	2091286675

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INTRODUCTION - Building Up The Foundation

1.1. Background

The idea of the project is to develop an attendance system application. As the name specifies it is software developed for managing various activities in the collage. Using facial recognition technology in attendance systems can be more accurate than using traditional techniques like badges or PIN numbers, which is one of the main advantages. This is due to the fact that facial recognition technology can recognize people based on distinctive facial traits that are challenging to imitate or fake. Additionally, facial recognition technology can be quicker and more practical than other approaches because all users need to do to record their attendance is to glance into the camera.

However, utilizing facial recognition technology in attendance systems could also provide a number of difficulties. The issue of privacy is one of the main ones. Biometric information collected by facial recognition technology can be used to follow individuals, and there are worries regarding how this information is handled both during storage and use. Concerns have also been raised concerning the possibility of using facial recognition technology for monitoring, which would violate people's privacy rights.

Making sure facial recognition technology is precise and dependable is another difficulty. Facial recognition algorithms are not flawless and are subject to error, just like any other technology. The technology may not accurately identify people if it is not calibrated or trained, which may result in inaccurate attendance records.

Overall, even though facial recognition technology has the potential to enhance ease and accuracy in attendance systems, it is crucial to carefully assess the risks and difficulties that could arise from using it. Additionally, it is vital to apply the technology in a way that prioritizes privacy.

1.2. Literature Survey

In our literature survey for the Attendance System using Group Face Recognition with Feedback, we thoroughly reviewed several research papers in the field. One significant contribution is the research paper titled "DeepFace: Closing the Gap to Human-Level Performance in Face Verification" by Y. Taigman et al. (2014). The paper introduces the DeepFace model, which leverages deep learning techniques to achieve remarkable performance in face verification tasks, reaching an accuracy of 97.35% on the Labeled Faces in the Wild (LFW) dataset. This demonstrates the effectiveness of deep learning approaches in accurate face recognition for attendance systems.

In our project, we incorporated the DeepFace model as a key component for face recognition tasks. By leveraging its pre-trained weights and architecture, we were able to extract robust facial features and perform accurate face matching, enabling us to track attendance efficiently.

We also explored various research papers that delve into attendance systems and the application of group face recognition. One notable paper we examined is "Class Attendance Management System using Facial Recognition" by Gomes, Clyde, et al. (2020). The conventional way of taking attendance leads to proxy through friends thus reducing effectiveness. So for that we choose bio-metrics but this lacks reliability and then we go for face recognition technology which is efficient & time saving. The works in 4 stages as Image Capturing, Face Detection, Face Comparison and Updating of Attendance in Database.

However, one of the challenges faced in attendance systems based on face recognition is the potential for false positives or false negatives due to variations in lighting conditions, pose, and facial expressions. To address this problem, our project incorporated a feedback mechanism. By leveraging feedback from human intervention, the system continuously learns and improves its accuracy over time.

1.3. Problem Statement and Requirement Analysis

The major Problems that motivated the solution are as follows:-

The requirement for an accurate, efficient, and secure method of tracking attendance in varied contexts is the issue that the attendance system employing facial recognition technology seeks to answer. Traditional attendance methods, like using ID badges or manual sign-in sheets, can be cumbersome and prone to fraud, which can result in erroneous attendance records and have a detrimental impact on accountability and productivity.

Compared to conventional attendance systems, facial recognition technology may offer a number of benefits, including quicker and more convenient attendance tracking, more accuracy, and improved security. People may easily log their attendance by simply looking at a camera when employing facial recognition technology, which can save time and lower the chance of fraud or mistakes.

Facial recognition technology can also be used to increase security in a variety of locations, including companies and schools. Unauthorized people may find it harder to access critical places or resources by having their identities confirmed by facial recognition.

However, there are a number of possible issues with integrating facial recognition technology into attendance systems, such as privacy worries and the possibility of biases or inaccuracies in the algorithms. Therefore, it is crucial to carefully weigh the possible advantages and hazards of installing a facial recognition attendance system and to make sure that accuracy, privacy, and security are prioritized throughout the design and implementation processes.

1. Attendance Tracking:

Efficient and Time-saving: A digitized attendance management system streamlines the process of recording and tracking attendance. It eliminates the need for manual attendance registers or paper-based systems, saving time and effort for both employees and administrators. With automated data capture and real-time updates, the system reduces administrative tasks and enables efficient attendance management.

2. Contactless and Hygienic:

Group facial recognition systems are contactless, eliminating the need for physical touch or proximity devices. Especially in times of health concerns or contagious diseases, this touchless approach enhances hygiene and reduces the risk of spreading infections.

3. Scalability:

Facial recognition systems can handle a large number of individuals simultaneously. This makes them highly scalable, suitable for organizations with large employee or student populations. The system can process attendance records efficiently without experiencing bottlenecks.

4. Security:

Group facial recognition systems provide enhanced security by ensuring that only authorized individuals can mark attendance. The technology can detect and prevent fraudulent activities, such as impersonation or buddy punching, where one person marks attendance on behalf of another.

5. Audit Trail:

The system can generate detailed attendance records, including timestamps and images, providing a reliable audit trail. This can be useful for tracking attendance patterns, analyzing trends, and resolving disputes or discrepancies.

6. Integration:

Attendance systems based on group facial recognition can be integrated with other existing systems, such as HR or student management systems. This enables seamless data synchronization and simplifies attendance tracking and reporting processes.

7. User-friendly Experience:

Group facial recognition systems offer a user-friendly experience for employees, students, and administrators. The process is intuitive and convenient, requiring minimal effort from users.

8. Cost-effective:

While initial implementation costs may exist, in the long run, group facial recognition attendance systems can be cost-effective. They reduce the need for manual record-keeping, minimize paperwork, and eliminate the costs associated with physical ID cards or other attendance devices.

9. Future Potential:

Facial recognition technology is continuously advancing, and there is potential for additional features and applications. As the technology evolves, it may offer further benefits, such as integrating with access control systems or providing real-time analytics for attendance management.

10. Enhanced Accuracy and Reliability using Feedback:

By incorporating a feedback feature in a group facial recognition attendance system, users can provide immediate feedback in case of mis-recognition or incorrect attendance records. This feedback loop allows the system to continuously improve its recognition capabilities, reducing the chances of errors and ensuring higher accuracy and reliability in attendance tracking. The ability to address and rectify mis-recognitions through user feedback enhances the overall performance and trustworthiness of the attendance system.

1.4. Feasibility- Technical and Non-Technical

Before initiating a project, it is essential to assess its feasibility. The various types of feasibilities can be summarized as follows:

1. Technical Feasibility:
  - The system should be compatible with various web browsers, including mobiles, tablets, desktops, and laptops.
  - Internet connectivity is required for the system to function properly.

2. Social Feasibility:
  - No similar system currently exists in NIT Jalandhar, making it a unique offering.
  - The system will reduce paper usage and contribute to environmental sustainability.
  - It aligns with the digitization movement initiated by the Honorable Prime Minister of India.

3. Economic Feasibility:
  - The development cost of this project is relatively low.
  - The main expense lies in database management.

4. Scope:
  - The attendance system aims to provide attendance functionalities for both students and teachers.
  - Since attendance is required for every lecture in every batch, the project's applicability extends throughout the existence of the college.

PROPOSED SOLUTION

2.1. Identifying Stakeholders

There are two main categories of stakeholders involved in the project:

1. **Admin**- The administrators are teachers who have the authority to upload images and record attendance. As administrators, teachers play a crucial role in managing the attendance system. They have the responsibility to upload the relevant images for facial recognition and ensure accurate attendance records.

2. **Students-** On the other end, the primary users are students. Students interact with the attendance system to view their attendance records and stay updated on their attendance status. They can access their attendance information through the student interface of the application.

Broadly, we have broken our project into two platforms-
1. **Web-Based Platform for our Admins**
2. **Application for Students**

2.2. Detailed Solution

Hereby, we present our solution in a detailed way, presenting the various things for our stakeholders:-

1. Login / Logout using Firebase Authentication:

Authentication will be carried out by firebase at backend . Firebase offers a highly secure authentication process that ensures the protection of user data and access to resources. When implementing authentication with Firebase, various security measures are employed to safeguard user identities and credentials. Firebase utilizes robust encryption protocols to secure the transmission of sensitive information, such as passwords and tokens. It supports industry-standard authentication methods like email/password,

social media sign-ins, and multi-factor authentication, adding an extra layer of security.
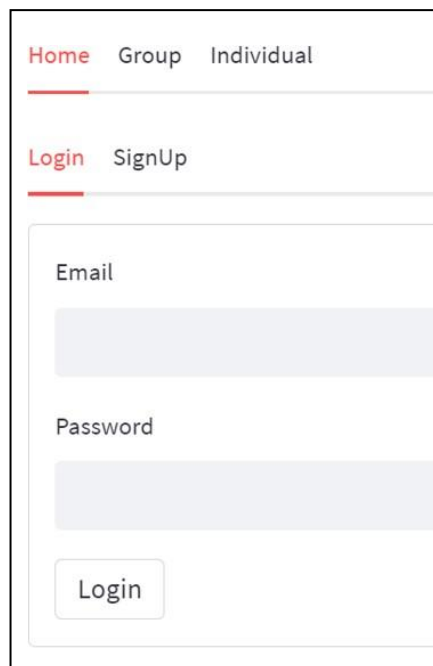
Identifier	Providers	Created ↓	Signed In	User UID
shashwatmishra156@gma...	✉	May 10, 2023	May 10, 2023	ilK1kJdwDaSdEJFGALgHDLHdfiw1

Fig: Firebase Authentication Portal

2. Customized workspace for each role:

The web application will differ in available options according to the role of the logged in user, i.e. depending on whether the user is student or teacher. This will be decided based on the role of user specified in realtime database. In case of teacher, they will have option to upload group image, and perform attendance list, while student can only view the group image and the attendance. Also the student will be able to submit reports regarding the recorded attendance, while the teacher will be displayed with the list of reports from the students.

Home   Group   Individual

Login   SignUp

Email

Password

Login

Fig: Same Tabs for Teacher and Students

3. Attendance Record:

After upload of group image by teacher, the application will process the image to extract faces, downloading individual image of students, which the student can upload from their side after account creation, and finally performing face recognition to match with the individual image.
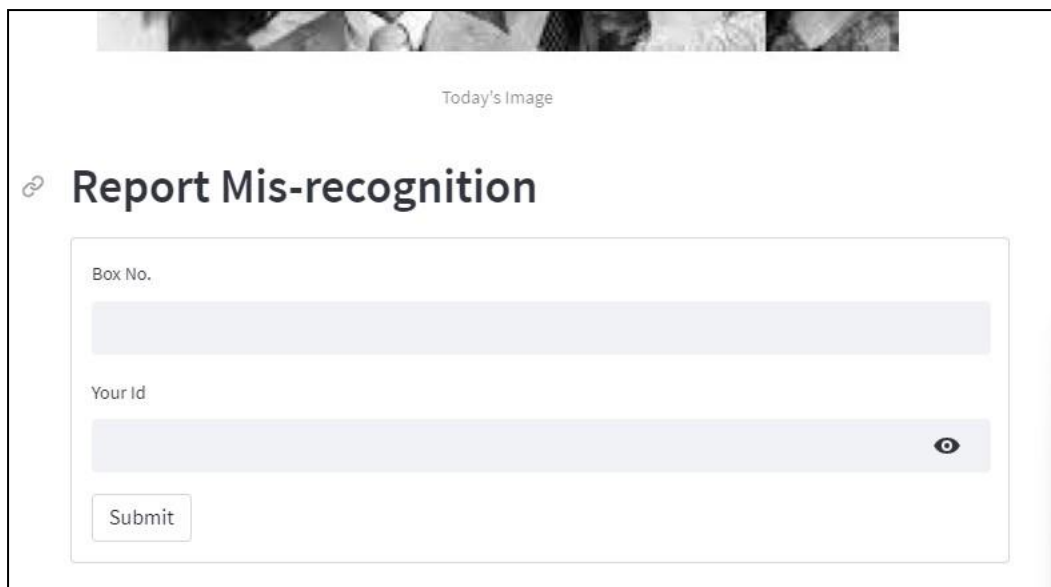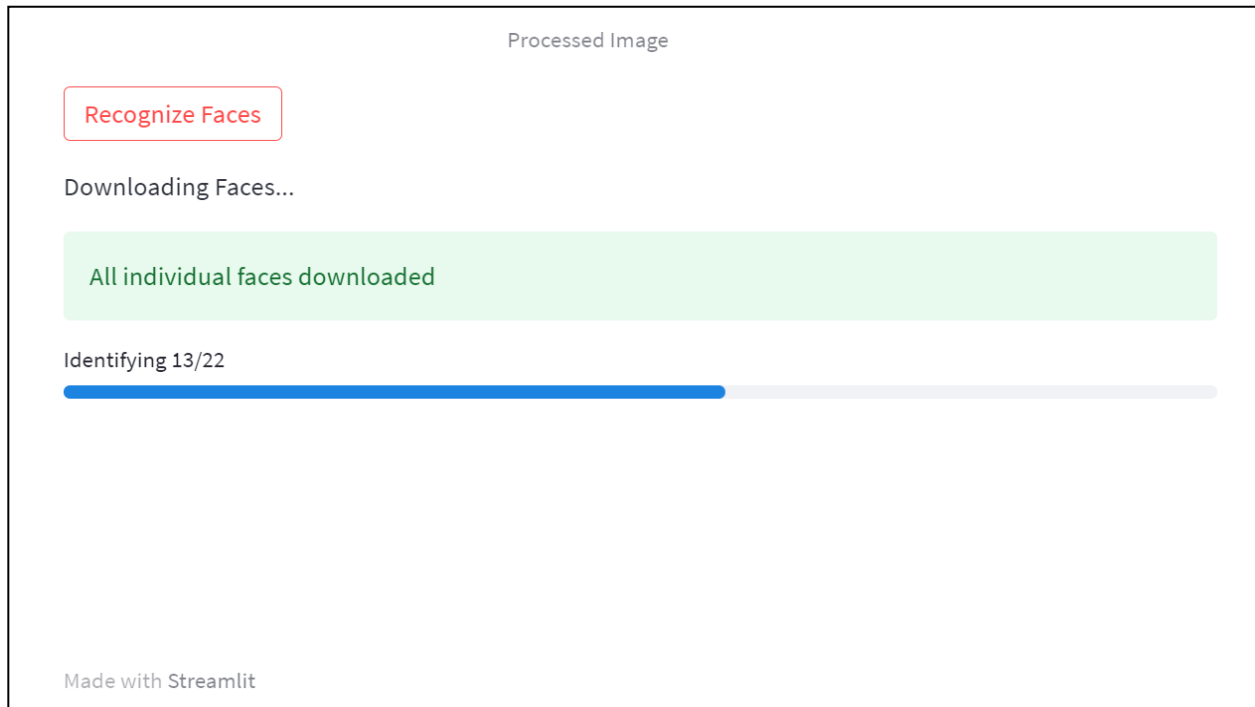

Fig: Necessary Steps being performed by application

The ML Model running at the backend performs face recognition using deepface module of python. For each extracted image, it returns the best matching face from the individual image list.

4. Feedback Mechanism:

The student has the option to report misidentification of his face in the group image as someone else. All the student reports will be visible to the teacher in order to reliable, error-free attendance recording.

Fig: Report Addition Interface for Student

5. Attendance Management:

Both Student and Teacher will be able to access the recorded attendance anytime anywhere. The finalized attendance everyday will be recorded in firebase realtime database, and will be loaded from the database on demand

TECHNICAL ANALYSIS

3.1. UML Diagrams

❖ Introduction:

These diagrams illustrate the interaction among different objects utilized in our project. They not only depict the exchange of messages between different phases of the system but also play a crucial role in the Software Development Life Cycle, making them an essential part of every developer's toolkit.

- The primary objective is to model objects and track the flow of messages between them.
- They help in representing various mechanisms within the logical scope of the application.
- They capture the interactions and message exchanges between objects and roles involved in collaboration.
- They facilitate modeling of alternative scenarios in use cases or functions, involving the collaboration of different objects and their associated operations.
- They assist in identifying objects and their attributes that play a significant role in conveying messages effectively.

1. **Class Diagram:**
   Class diagrams are utilized to model the structure of an application, serving as a foundation for code generation. They provide a means for representing and modeling data. The classes depicted in a class diagram represent the core components, interactions, and essential classes that need to be implemented in the application. By leveraging class diagrams, developers gain a clear

understanding of how to approach the problem and can generate code accordingly. It offers a comprehensive view of the systematics, aiding in effective problem-solving and development.
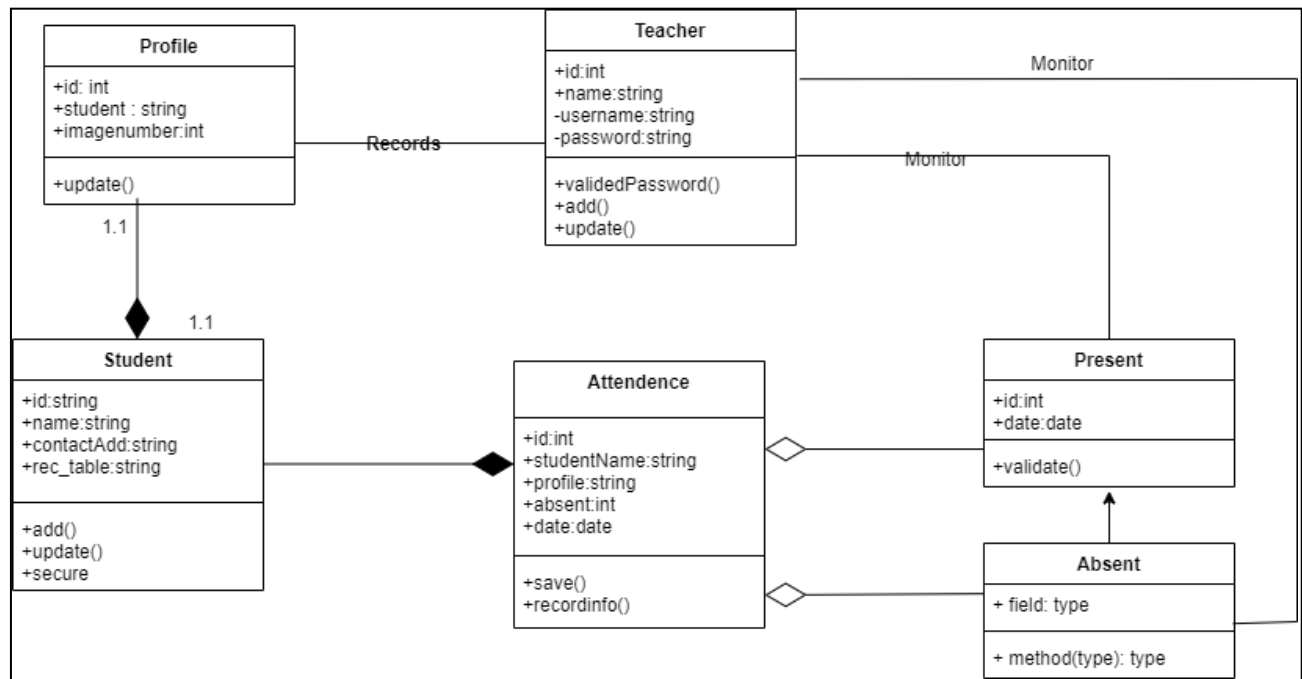
Description:

In this project we have Profile, Teacher/Admin, student, attendance, present and absent . Here we have teacher class attributes like id , username and password then teacher can login and view or check if the student is present or not .

In student class we have id, name, contactadd, rec_table which will help student to login in with their respective id's.

In Present class we have id and date of specific id so their we can check for specific day and check for absent class and stores entire thing in database

Warden can manage student profile and visit their profile and see status. Student Class has attributes like their parent's information, attendance status and getter or setter method by which data can be updated.

Person Class contains all users' personal information like name, age, mail, phone etc. of all users of this application.

Person class is inherited by two child class warden and Students. Mess and Food are two classes that are related to student mess bill.

Food Class contains details of food like food id, food type, rate etc. Mess Class contains mess bill of students and method for updating mess bill. Mess Class is having two parent classes namely Student which contains student information like name, roll no etc. and Food which contain food details.

Database Manager Class is for updating the data in database, which contain updating methods of attendance and mess bill. In our project We are using Google Firebase of Google Cloud Platform.

2. <u>Use Case:</u>

A Use Case Diagram illustrates the different ways in which stakeholders interact with our application. It uses circles or ellipses to represent the stakeholders (actors) involved and their connections to the application's functionalities. This diagram provides a high-level overview of the software development process and is designed to be easily understandable and visually intuitive. By mapping out the interactions between actors and functionalities, the Use Case Diagram helps to identify the key usage scenarios and user roles within the application.
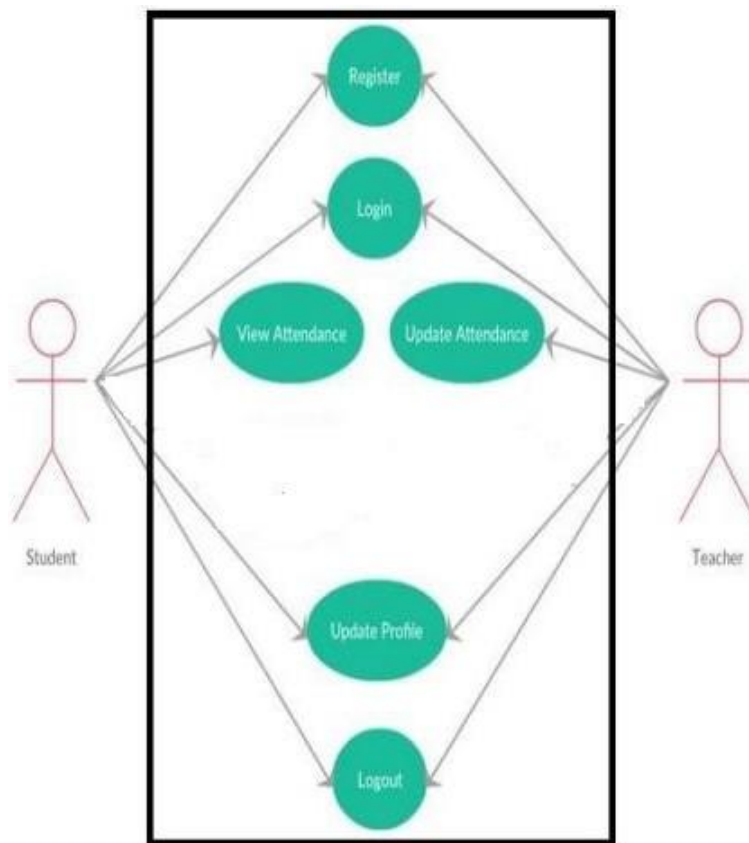
Description:

Name: Attendance Management System using Face Recognition for Students and Teachers Primary

Actors: Student, Teacher

Pre-Condition: The web app is running, Students and teachers are

registered in the system and have students have their facial features captured and stored. The camera and facial recognition web app are functioning properly.

Goal: To accurately and efficiently track attendance using facial recognition technology, and provide features for students and teachers to view and manage attendance records.

Summary: Students can having mainly five functions namely - Login, Update personal details, View bill, Apply Hostel or Mess Leave, Review their Leave.

Basic Flow for Student:

1. The student logs in to the system using their registered credentials.

2. The student is presented with a dashboard that displays their attendance records, shortage report, and profile information.

3. The student can view their attendance records for specific dates or time periods.

4. The student can update their profile information, such as their name or contact information.

 5. The student logs out of the system.

Basic Flow for Teacher:

1. The teacher logs in to the system using their registered credentials.

2. The teacher is presented with a dashboard that displays their class attendance records, shortage report, and profile information.

3. The teacher can view attendance records for individual students or the entire class for specific dates or time periods.

4. The teacher can update attendance records for individual students or the entire class.

5. The teacher can update their profile information, such as their name or contact information.

6. The teacher logs out of the system.

Similarly Admin can login the portal, Update Student Personal details, View Student record or bills, Update their bills , Respond to the complaints, View the hostel leaves.

Post Condition: User mustn't forget to logout the application.

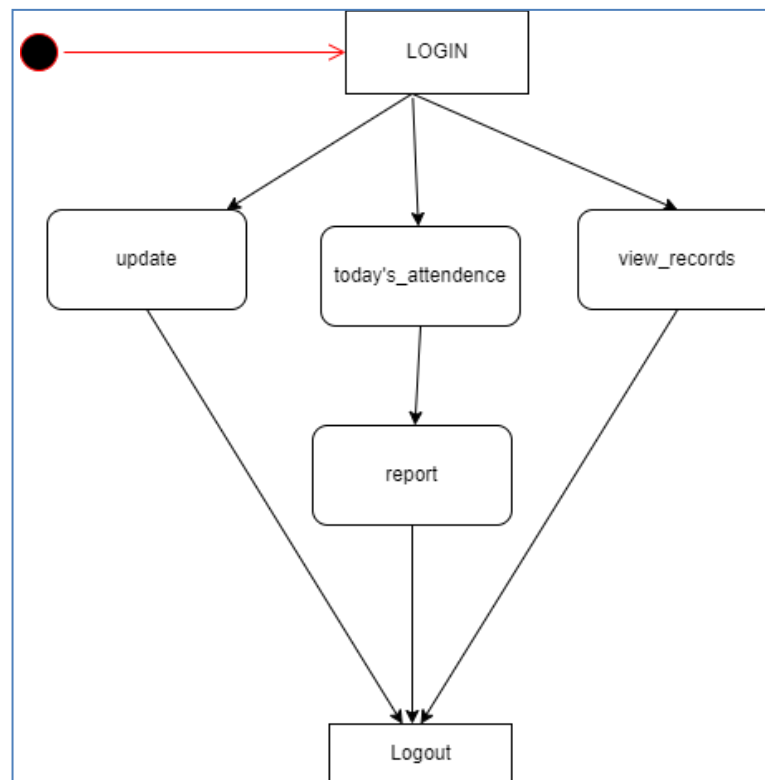3. **<u>Activity Diagram</u>:**
   Activity diagrams are utilized to illustrate the sequential workflow of activities, including steps and decision points. They play a crucial role in UML modeling as they depict the progression from one phase to another within an application. These diagrams represent the flow of control as it moves through different phases, ultimately reaching a stop or end point. By depicting the various activities performed within the application or software, activity diagrams provide a visual representation of the overall process.

   We have two types of activity diagrams:
   1. Student's Activity Diagram
   2. Admin's Activity Diagram

   Description:

a. Student Activity Diagram:

An Activity Diagram is a visual representation of the workflow in a system, illustrating the sequence of activities and the decisions, iterations, and parallel processes involved. First Student will login with their login credentials and in the next step there are multiple choices for student. They can Update their images, View attendance records, can report about today's unsubmitted attendance, if face any issues.

For the safety purpose they can logout after finishing the work.

b. Admin Activity Diagram:

Just as a student, Admin must login to the portal for security as the first step. After Successful login they can manage student record or personal information, update image, attendance, and can view student reports.

After viewing the reports they have resolve reports by either accepting or rejecting.

After finishing the work they will logout the portal so that no one can misuse this application.
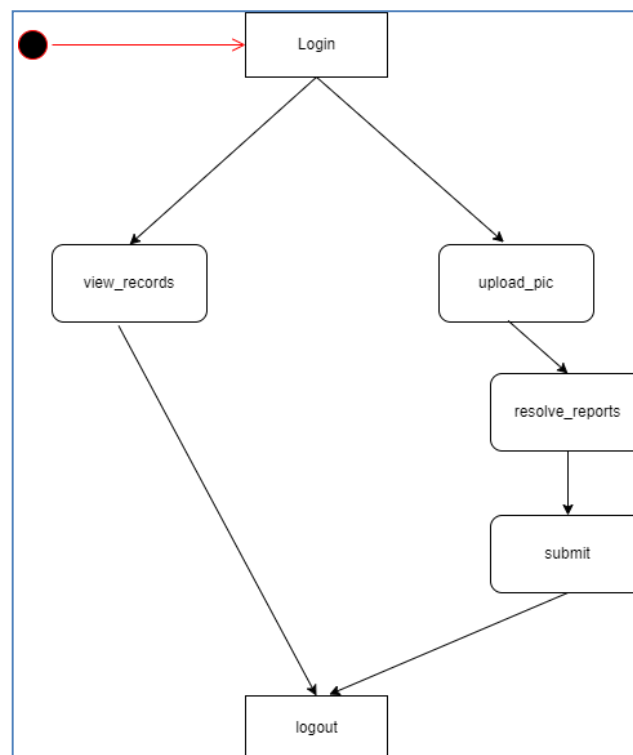
4. <u>Sequence Diagram</u>:

A Sequence Diagram is a visual depiction of the sequential interactions between objects. It represents the objects and classes utilized in an application and shows the flow of messages exchanged between these objects to accomplish specific functionalities. These diagrams are closely related to the realization of use cases within the logical view of the system being developed and are sometimes referred to as event diagrams. In a Sequence Diagram,

vertical lines called "lifelines" run in parallel, and the horizontal arrow-like symbols represent the messages exchanged between different objects, arranged in the order of their occurrence. This graphical representation provides an intuitive visualization of the system's runtime behavior.

Description:

Here Student, Admin, Mobile (Web) Application are Classes which interact to each other. Student will send login request on application. After checking the login credential by internally decoding MJ5 Key and by server, acceptance or rejection will be sent to particular student. Similar process is meant for admin for web portal.

Now Admin will upload class group image of students on application. Successfully Logged in Students as well as the teacher can view the image.

The app will now process the image to detect faces. The result of the recognition will be temporarily saved in the database and will be available for the students and teachers.

Students can register reports regarding wrongly identified. These complaints are responded by admin by updating the attendance after which student will receive the status of their complaints.

Finally after resolving all thee reports, admin can now submit the attendance to save it permanently. All past finalized attendance records will be available to both students and teachers.

After Completion of work both can logout from the web apps.

The Sequence diagram can be viewed on next page and marks the various Sequence flow of the Application.
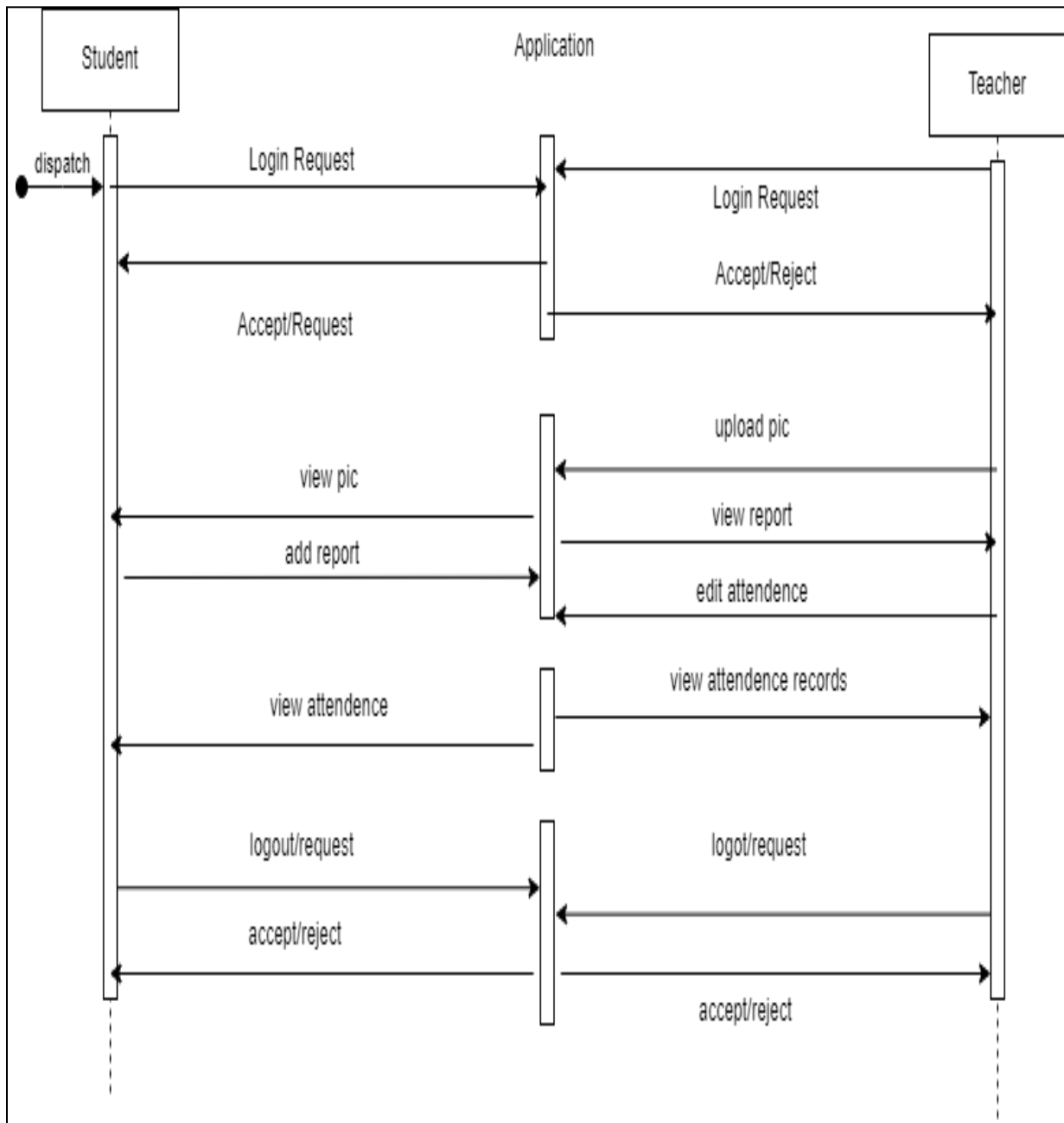
Fig. Sequence Diagram

3.2. Tech Stack Analysis

To accomplish different objectives, we have employed a range of technology stacks. The selection of these technologies was based on a set of specific criteria, including the following:

1. Ease of Usage and Ease of Learning
2. Time Required to build
3. Efficiency
4. Security

On the basis of the above mentioned criteria the Technologies used are:-

1. Database, Authentication, Storage- Firebase

Firebase is an online app and web development platform developed by Firebase, Inc.

It is a google backed application that provides multiple cloud functionalities for your app, such as Realtime database, storage, authentication, etc.

USAGE: We have used Firebase for our **Real-time Database** (for storing attendance and user information)**, Storage** (for the Storage of our facial images), and **Authentication** (for student and admin side authentication using email and password).

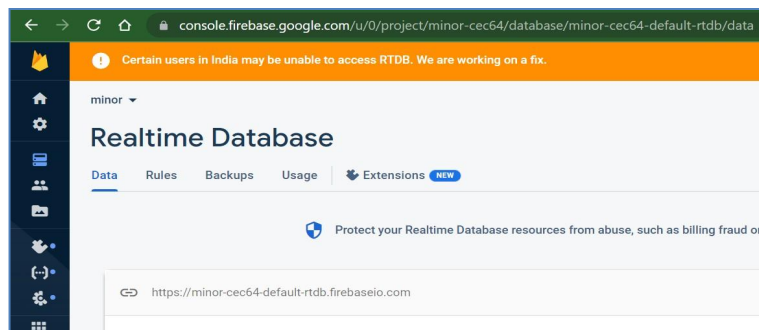1. The **RTDB** is currently unavailable due to an error at Google's end.

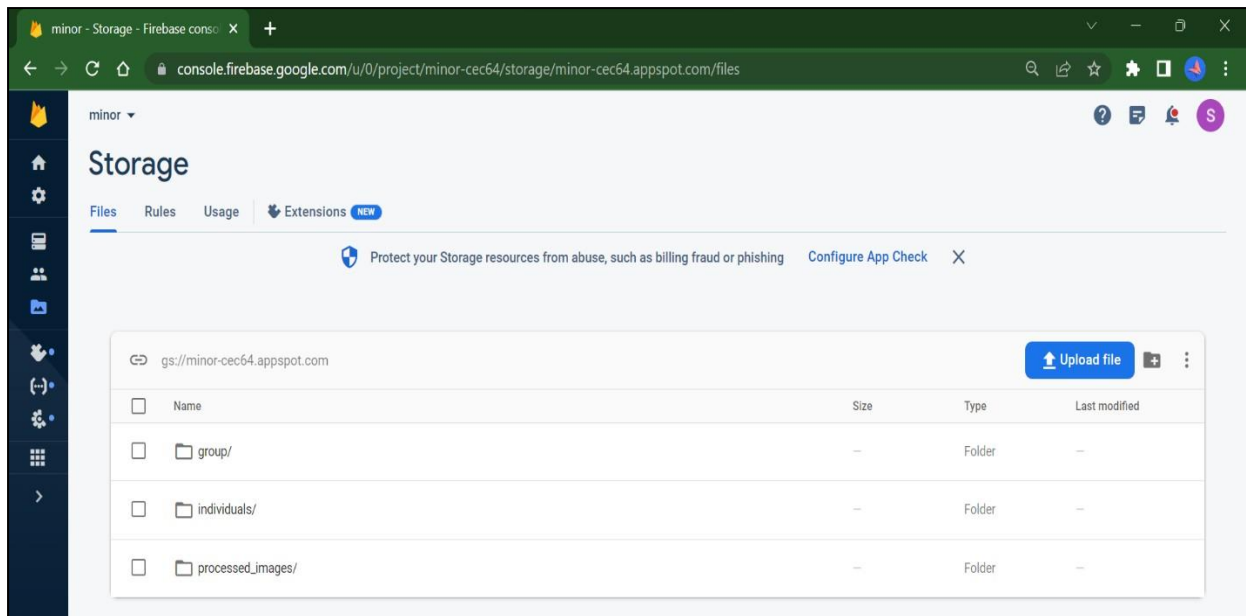**Fig. Firebase Realtime Database Interface**

2. The **Storage Schema:**

Fig. Firebase Storage Interface

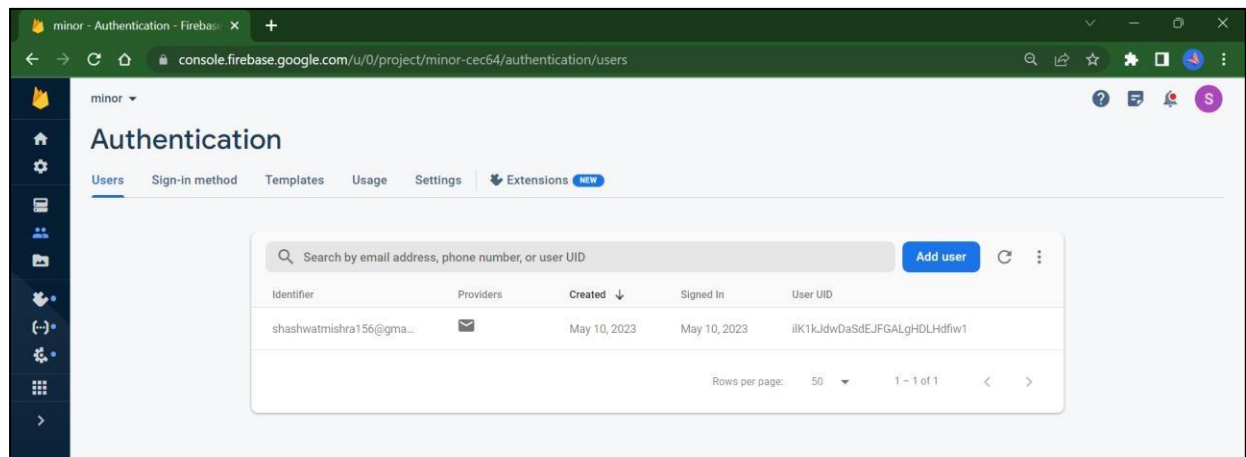3. Firebase **Authentication**:

Fig. Firebase Authentication Interface

2. <u>Face Recognition - Deepface</u>

DeepFace is a facial recognition system developed by Facebook's AI research team. It utilizes deep learning algorithms to analyze and recognize faces in images or videos. DeepFace achieved remarkable accuracy in face identification, surpassing human performance in some cases. It has a model with over 120 million parameters, making it capable of representing faces with great detail and robustness. DeepFace's training data consists of around 4 million images and covers a wide range of individuals from different demographics and geographies. With an accuracy of around 97%, DeepFace has proven to be a powerful tool for face recognition tasks, offering applications in various fields such as security, user authentication, and social media.

Fig. Accurate Face Detection using Retinaface library of Deepface
Source: Sefik I. S. (2021). *The Yellow Angels - Fenerbahce Women's Volleyball Team [Image]* https://raw.githubusercontent.com/serengil/deepface/master/icon/retinaface-results.jpeg

DeepFace has been extensively evaluated on the Labeled Faces in the Wild (LFW) benchmark, which is a widely recognized dataset for face recognition. On the LFW dataset, DeepFace achieved an impressive accuracy of over 97.35%, outperforming other existing face recognition methods at the time of its release. This accuracy rate was comparable to human performance, highlighting the significant advancements made in the field of facial recognition.

In addition to LFW, DeepFace has also been tested on other datasets, including the YouTube Faces Dataset (YTF). On the YTF dataset, DeepFace achieved an accuracy of approximately 91.4% in verifying whether two face images belong to the same identity. These results demonstrate the robustness and effectiveness of DeepFace across different datasets, further establishing its capabilities in face recognition tasks.

3. <u>Web Designing- Streamlit</u>

Streamlit is a Python framework that is open-source and enables the development of interactive web applications tailored for tasks related to data science and machine learning. By using Streamlit, you can effortlessly construct user interfaces that are both visually appealing and user-friendly. Its syntax is straightforward and declarative, facilitating the creation of diverse components like sliders, buttons, plots, and text inputs. The integration of backend and frontend functionality is seamlessly handled by Streamlit, streamlining the deployment of your applications. Additionally, it supports real-time updates, allowing your app to dynamically react to user interactions and data modifications. In summary, Streamlit is an invaluable resource that simplifies the creation and distribution of data-centric applications.
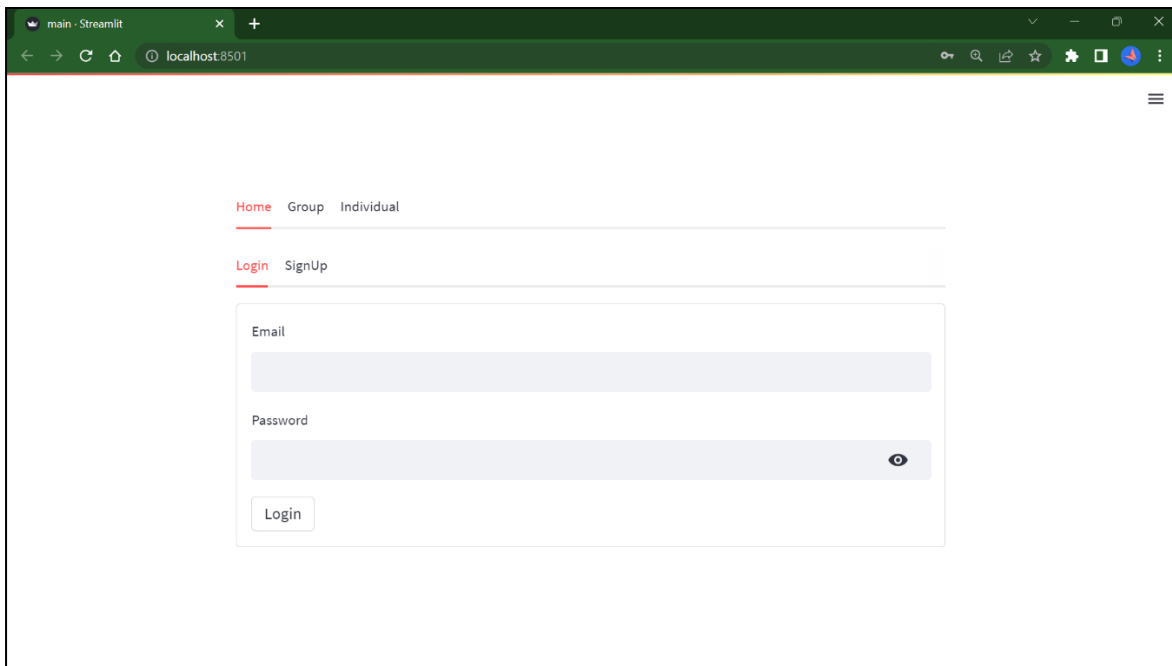

Fig. Streamlit-based Home Page

ECONOMIC ANALYSIS

Our goal is to offer an affordable and user-friendly solution that is well-equipped to address everyday challenges.
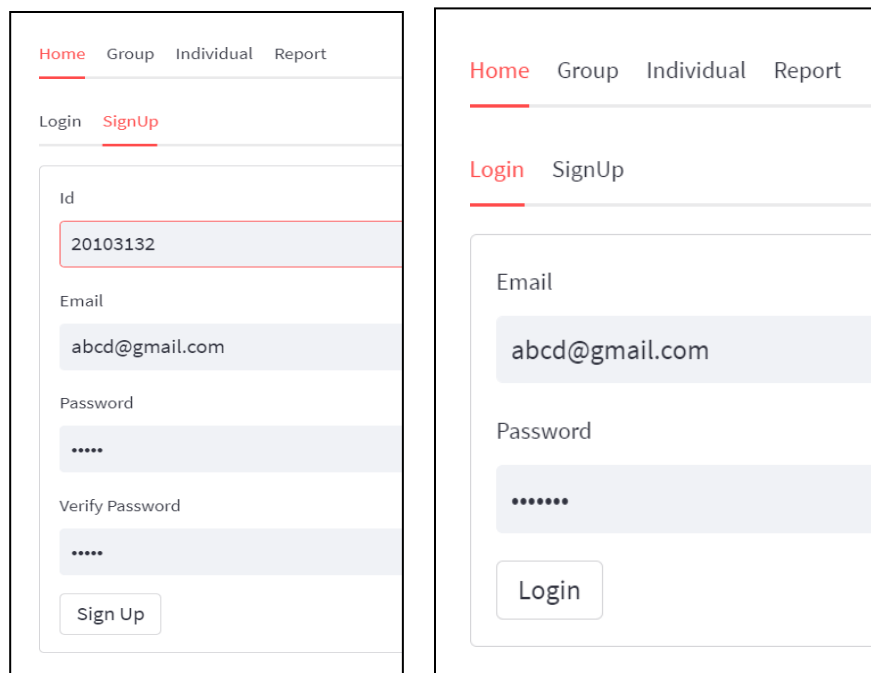
- When it comes to the development stacks we utilize, they are freely available. Therefore, all you need is an internet connection and a laptop, with no additional costs.
- For the database and storage requirements, we rely on Google's Firebase, which provides generous free limits, including 5GB of database storage and 1GB of storage space.
- All the APIs and dependencies we utilize are also free software, requiring only support and a willingness to embrace change.

RESULT AND DISCUSSION

4.1. App Usage Instructions

1. Login / Sign Up

The sign up process will require id along with email and password. Email-verification feature will also be available in future to get rid of malicious email ids. Also, the id given at sign up can be verified with the college database to decide role of user.

Fig. Basic Login/Sign Up Interface

2. Upload Group Image (Teacher Side)

Teachers will be able to upload image by browsing the files. This uploaded image will further need to be processed (detect and extract faces), and recognized (match face with student individual faces). Teacher will also be able to retain stat, i.e. uploaded, processed, or detected.
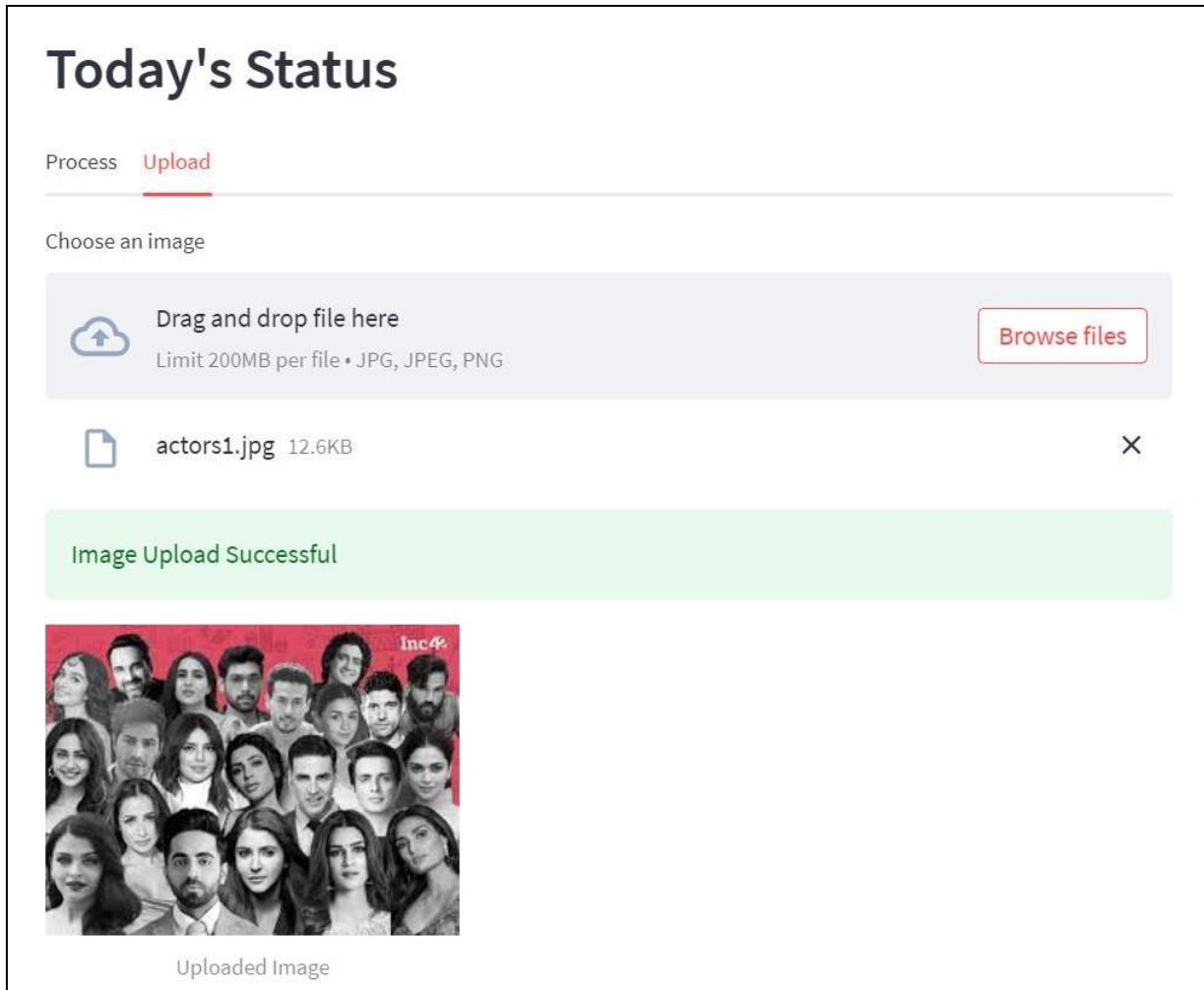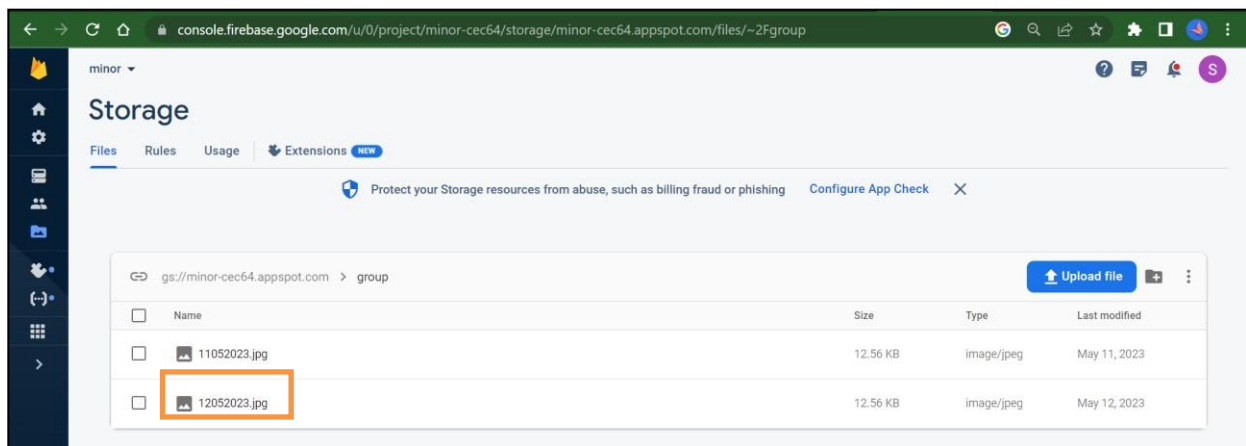
Fig. Uploading group image

Fig. Image being uploaded at Firebase Storage

3. Processing Image:

The attendance retrieval from group image is divided into two parts: (1) Detecting and extracting faces from the uploaded group image, and (2) Recognizing extracted image.
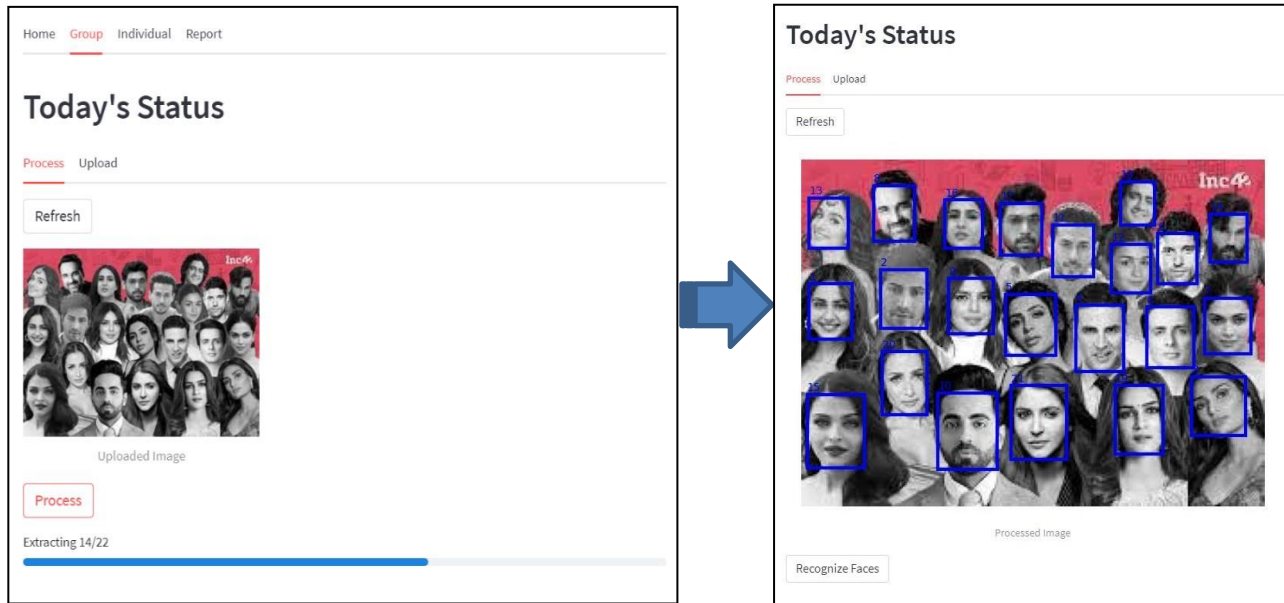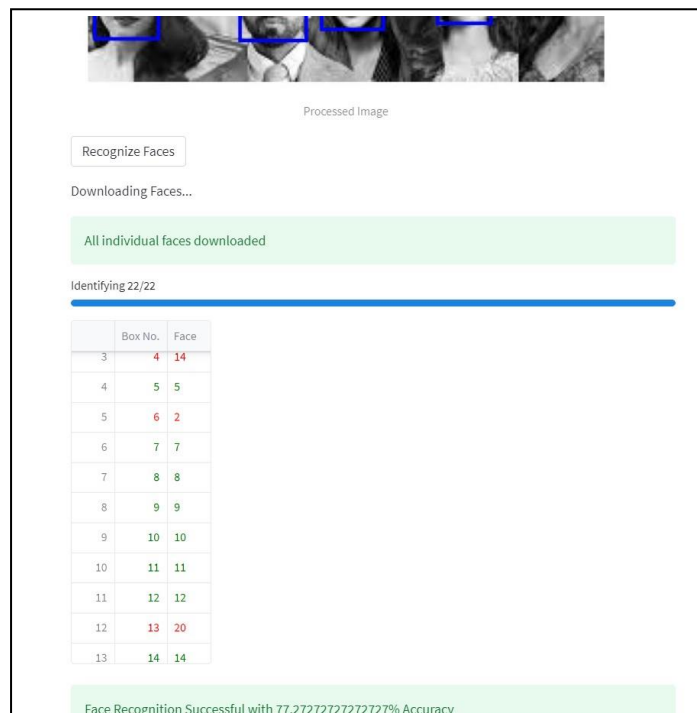

Fig. Detecting and Extracting Faces

Fig. Recognizing Faces
(Accuracy calculated as app was in testing phase)

4. Uploading Individual Pic (Student):

Student can always update his face image to the most recent one, again, simply by browsing in his/her system, which will be further processed and then uploaded to firebase storage.
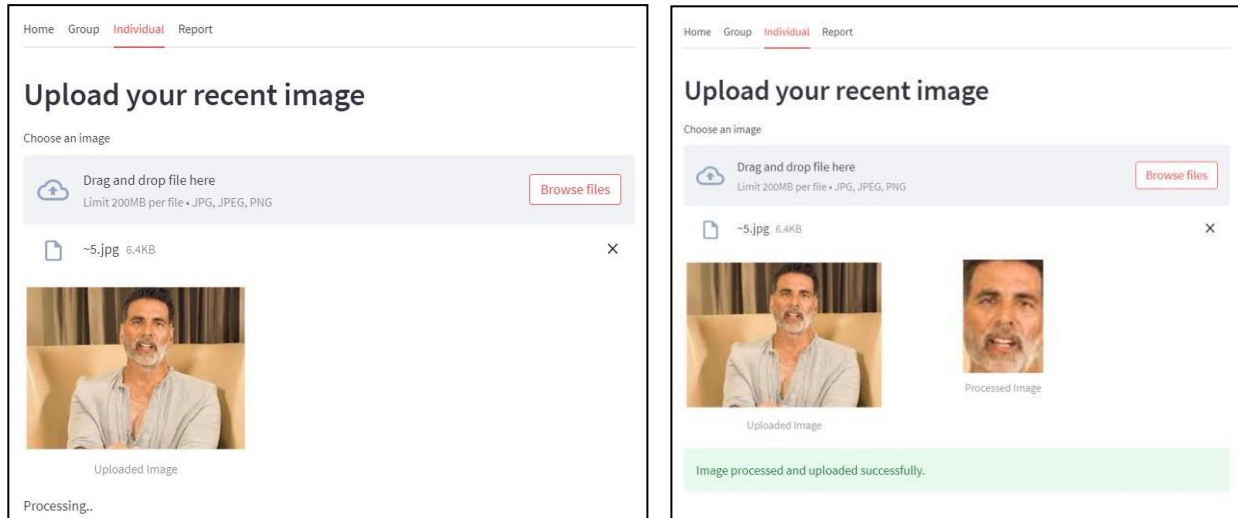

Fig. Interface for student to upload recent face image

5. Reports (Feedback):

Student can give feedback, i.e. report mis-identification using reports form. The admin will be available to see all the reports listed by students.
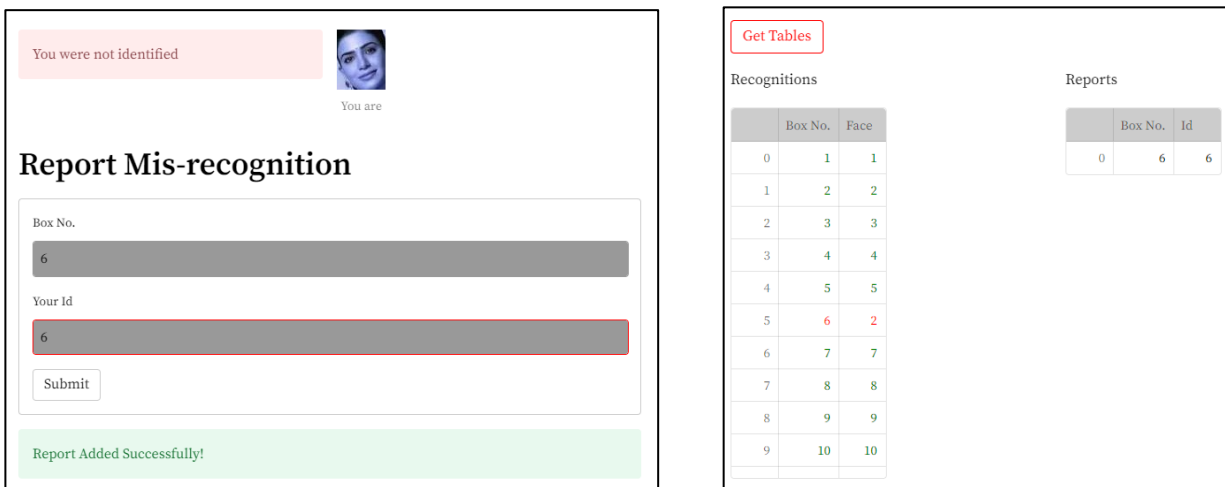

Fig. Interface for student to report mis-identification(left), Reports and recognition table for admin(right)

4.2. Risk Analysis

Every project, whether it involves design or development, inherently carries certain risks. These risks play a crucial role in making the project worthwhile. In the case of our project, "Attendance System using Group Face Recognition," we have identified several risks that we need to address:

1. Risk of Libraries Management: This risk pertains to effectively managing the various libraries and dependencies used in our project to ensure compatibility and smooth functioning.

2. Non-Acceptance by Stakeholders: There is a risk that the stakeholders may not fully accept or embrace this system due to various reasons such as concerns about privacy, technological limitations, or resistance to change.

3. Firebase Storage/Database Issues: There is a risk of potential issues or crashes with the Firebase storage or database, which could impact the reliability and availability of the system.

Among these risks, the primary concern lies with the second point as the acceptance and adoption of the system by stakeholders are crucial for its success. To mitigate this risk, we have engaged in extensive discussions and consultations with both technical and non-technical stakeholders. We have sought their feedback, addressed their concerns, and incorporated their suggestions to ensure a higher level of acceptance.

Additionally, we have taken proactive measures to minimize risks. We have implemented regular maintenance procedures for our web application, enabling us to recover from any crashes or issues efficiently. Moreover, we rely on the expertise of Google Developers to handle rare cases of server crashing, thus reducing the impact of potential technical risks.

Through effective risk management and open communication with stakeholders, we have strived to minimize the risks associated with our project and increase its chances of success.

4.3. Deployment and Testing Status

Due to an unexpected Firebase database crash, we encountered difficulties in deploying our web application as initially planned. The database crash occurred at a critical stage of our project when we were preparing for deployment. This unforeseen event led to a temporary setback in our timeline. Considering the limited amount of time available, we had to swiftly adapt our approach to ensure continuity in the project.

   As a solution, we made the decision to shift our testing phase to a local database environment. This alternative approach allows us to continue testing and evaluating the functionality of the web app without being reliant on the Firebase database. Although the database crash posed a challenge, we have taken proactive measures to ensure that our project continues to progress.
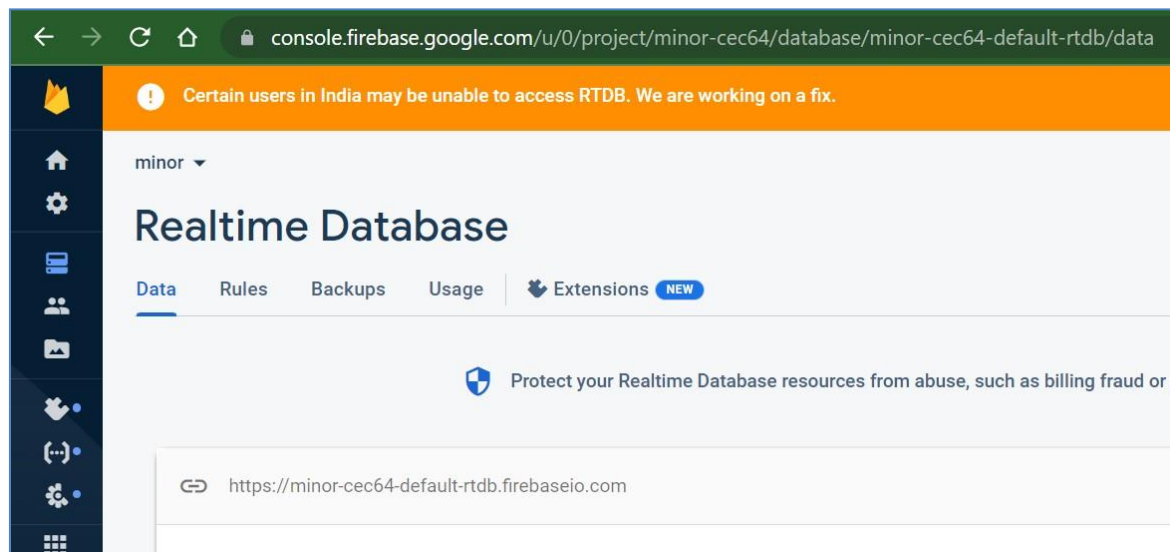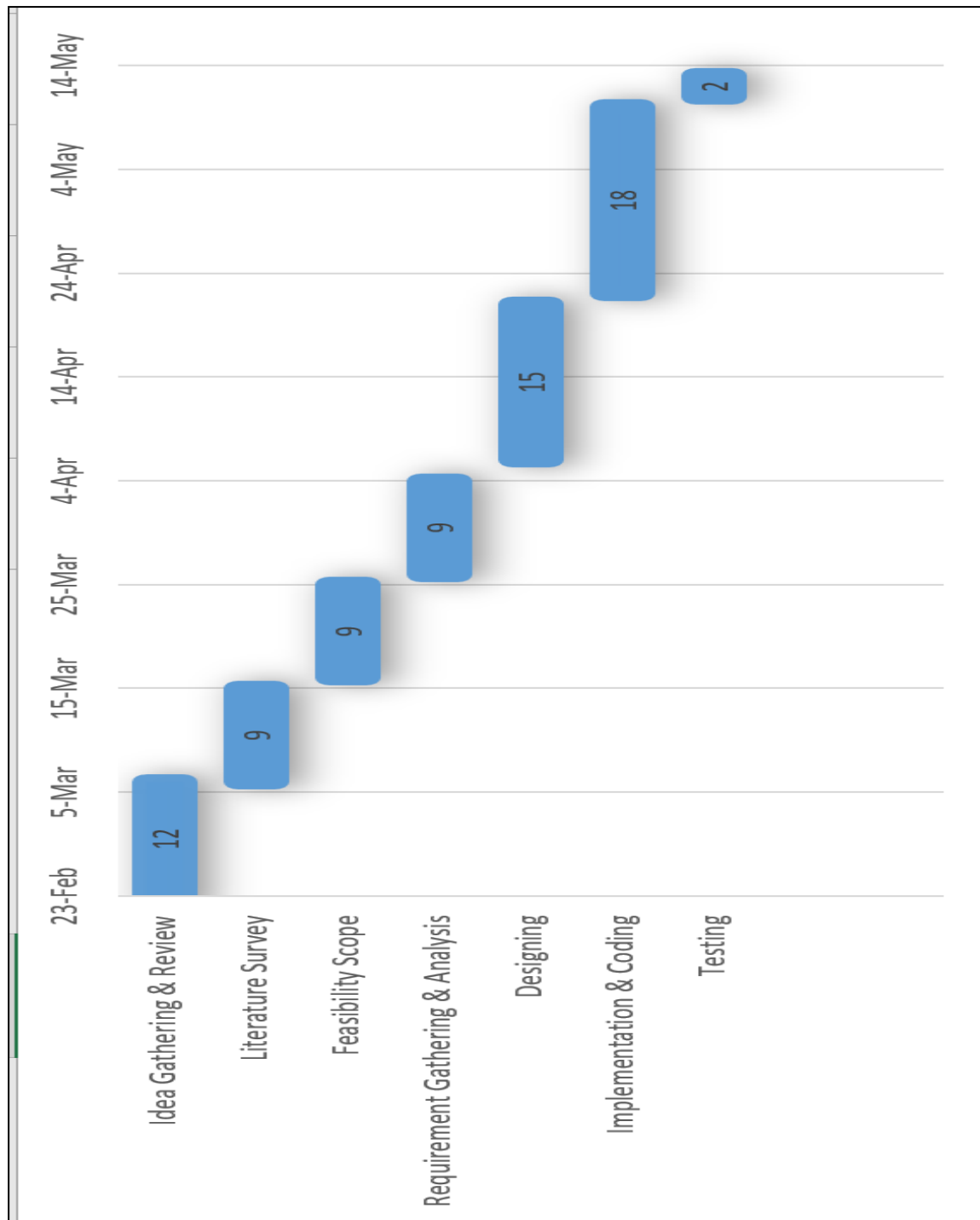

Fig: Error Accessing Firebase Real-Time DataBase

4.4. Gantt Chart

SOCIAL AND ENVIRONMENTAL IMPACT

Shifting from a conventional attendance system to a machine learning (ML) group face recognition system with feedback can have several social and environmental impacts. Here are some examples:

1. Enhanced Efficiency: The ML group face recognition system can streamline the attendance process, eliminating the need for manual tracking and paperwork. This improves efficiency by saving time and resources for both students and teachers.

2. Improved Accuracy: The use of ML algorithms for face recognition can significantly reduce the chances of errors or discrepancies in attendance records. This promotes fairness and accuracy in tracking attendance, ensuring that students receive proper credit for their attendance.

3. Environmental Sustainability: By transitioning to a digital system, the ML group face recognition system reduces the need for paper-based attendance registers or ID cards. This helps in minimizing paper waste, contributing to environmental sustainability and aligning with the principles of a greener campus.

4. Positive Student Experience: The shift to a modern attendance system can enhance the overall student experience. It offers a convenient and seamless process for marking attendance, reducing the administrative burden on students and teachers. This allows them to focus more on academic activities and engagement in the learning process.

CONCLUSION

The ML model for face recognition is up and running with high accuracy (above 81%), especially considering the quality of group images and the number of training images provided (just 1 for each user). Due to server side issues occurring while fetching realtime database, the project could not be made fully functional. Despite the limited time available, we tried to deliver a commendable professional performance. The Trial Run has been successful and has yielded clear results than can be used in further improving the model.

In conclusion, our objective has been to develop a user-friendly and cost-effective solution that addresses the challenges encountered by students, teachers, and administrators.

Our journey towards digitization has been aligned with the vision of simplifying tasks through the power of technology. Throughout this process, we have gained valuable technical skills and non-technical insights that go beyond the realm of coding. From meticulous task planning to effective scheduling and seamless teamwork, we have honed our abilities to ensure a smooth and efficient development process.

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Citations and References:

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- Streamlit: https://www.streamlit.io/
- Pyrebase4: https://github.com/nhorvath/Pyrebase4
- Firebase: https://firebase.google.com/docs/reference/admin/python
- Stack Overflow.

Thank you.
We appreciate your suggestions and
welcome any further input or ideas you may have.

---------------END OF REPORT--------------