CMSC 190 SPECIAL PROBLEM

CLASSPIC:

AUTOMATED ATTENDANCE CHECKING WEB APPLICATION USING FACIAL RECOGNITION

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INTRODUCTION

What is Attendance Checking?

It is an essential aspect of classroom management, it makes sure that students maximize their potential for leaning by attending every single class.

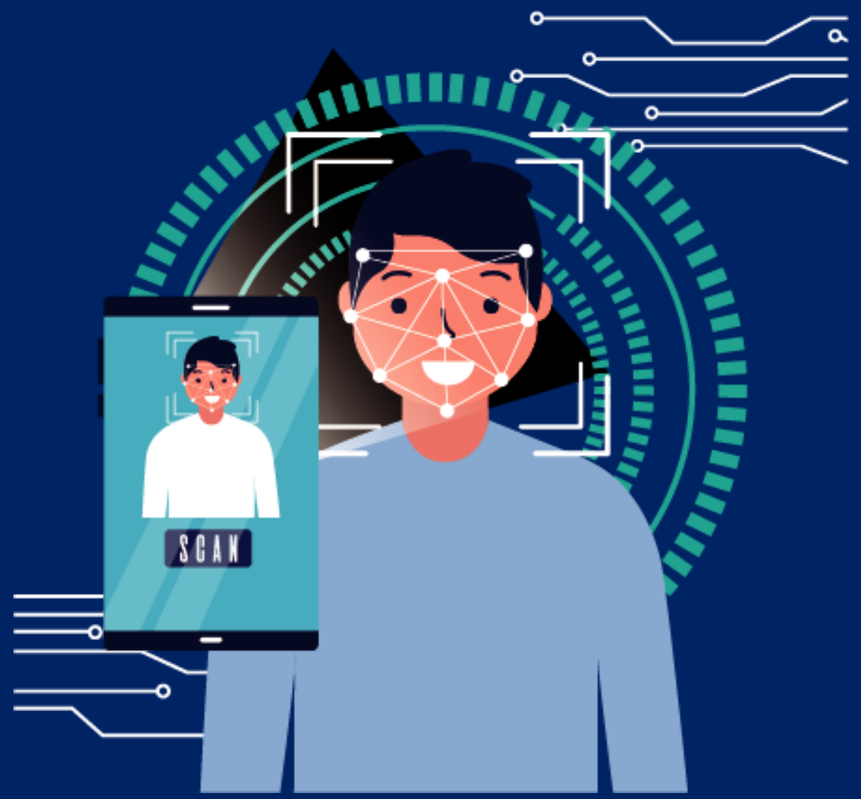
Status Quo of Attendance Checking

Issues and Problems

- **Efficiency**
- **Can be cheated, lost or stolen**

FACIAL RECOGNITION

It is a recognition technique used to detect faces of individuals whose images are stored in a database. It uses algorithms to pick out specific, distinctive details about a person's face. These details are then converted into mathematical representation and then compared to other faces in the database.



Current Uses

- **Security**
- **Healthcare**
- **Marketing**

OBJECTIVES

The general objective of the study is to implement a web application that utilizes facial recognition which will be used to automate attendance checking. It specifically aims to:

- **Create a web application for teachers to easily manage the attendance of a class;**
- **Generate a spreadsheet that contains the attendance record using the web application; and**
- **Assess the overall performance of the developed application.**

RELATED STUDIES

Existing Attendance Checking Technologies

- **Radio-Frequency Identification (RFID)**
- **Geolocation**
- **QR Code**

Utilizes Facial Recognition

- **Facial Recognition using CCTV**
- **Facial Recognition for PC Platform**
- **Facial Recognition for Mobile**

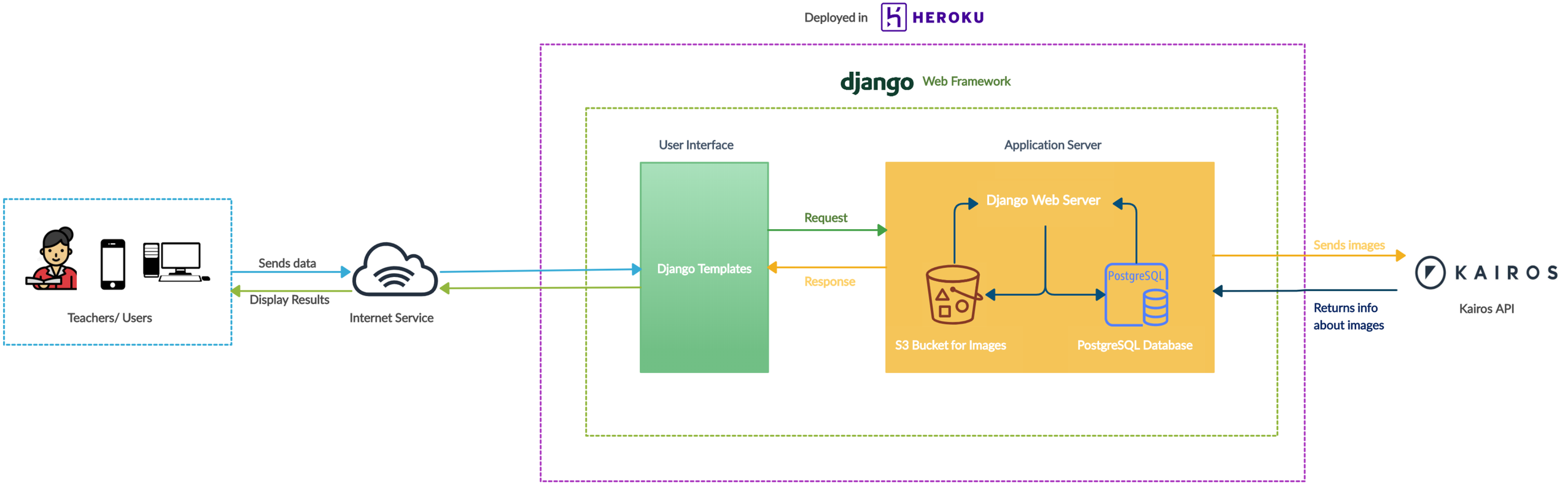
METHODOLOGY

Image Acquisition

- **Household of 10 people**
- **12MP Main Camera of Samsung S9+**
- **8MP Front Camera**

METHODOLOGY

Architecture of the Application



METHODOLOGY

Kairos API

Kairos provides state-of-the-art, ethical face recognition to developers and businesses worldwide. Through computer vision and deep learning, we recognize faces in videos, photos, and the real-world—our innovative API platform simplifies how you integrate human identity into software products.

Kairos is state-of-the-art—scoring 99.63% on the popular LFW database. That said, accuracy of individual results really relies upon the quality of submitted images/video and the settings customers choose through our API. Like any technology, the more controlled the environment, the better the results.

Face Templates

Each time you enroll a face into the API, it extracts the facial features, generating a template of the features as a random alphanumeric string of code. This anonymizes the facial data therein and the template cannot be reverse engineered back into a photo. When you compare faces in our system, you are actually comparing templates. So, each enrolled face counts as 1 template.

METHODOLOGY

Generation of Face Templates

Add Student

Input Image

POST /enroll

KAIROS

Goes through Kairos AI

Face Templates

numeric representation of the features found for each specific face in the photo.


```
200
Content-Type: application/json

{
  "face_id": "5410001743ab64935982",
  "images": [
    {
      "attributes": {
        "lips": "Together",
        "asian": 0.25658,
        "gender": {
          "type": "F"
        },
        "age": 26,
        "hispanic": 0.41825,
        "other": 0.11144,
        "black": 0.16007,
        "white": 0.05365,
        "glasses": "None"
      },
      "transaction": {
        "status": "success",
        "topLeftX": 390,
        "topLeftY": 706,
        "gallery_name": "MyGallery",
        "timestamp": "1487012582681",
        "height": 780,
        "quality": 0.79333,
        "confidence": 0.99997,
        "subject_id": "Elizabeth",
        "width": 781,
        "face_id": 1
      }
    }
```

METHODOLOGY

Attendance Checking and Recording

Take ClassPic

Input Image

/recognize

KAIROS

Goes through Kairos AI

List of candidates

if the similarity of a detected face in the input to a face in the gallery is greater than a set threshold it is added to the list of candidates

Attendance is created

the list of candidates is converted to list of present stidents

Generation of .csv

Attendance can be exported to a .csv file

METHODOLOGY

Attendance Checking and Recording

App False Match Rate	Threshold Required
1 in 10	**.50**
1 in 50	.60
1 in 100	.70
1 in 500	**.75**
1 in 1,000	.80
1 in 5,000	.87
1 in 10,000	**.90**
1 in 50,000	.95
1 in 100,000	.97
1 in 200,000	.99
1 in 500,000	.995
1 in 1,000,000	.999

RESULTS AND DISCUSSION

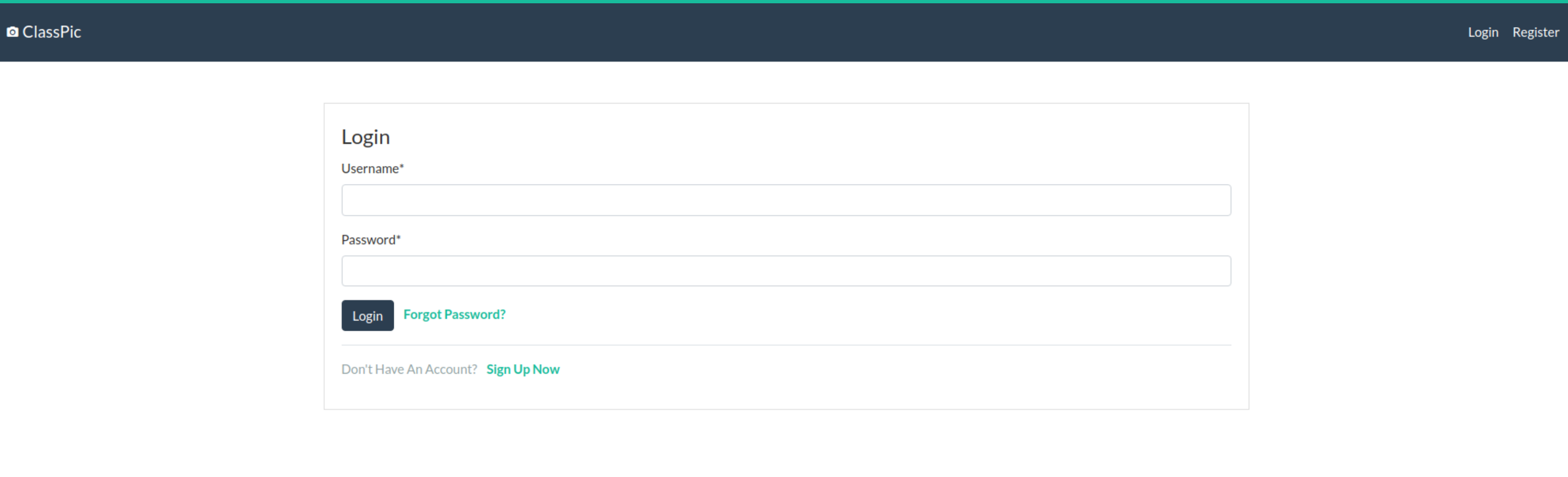
Web Application

Technology Stack

RESULTS AND DISCUSSION

Web Application

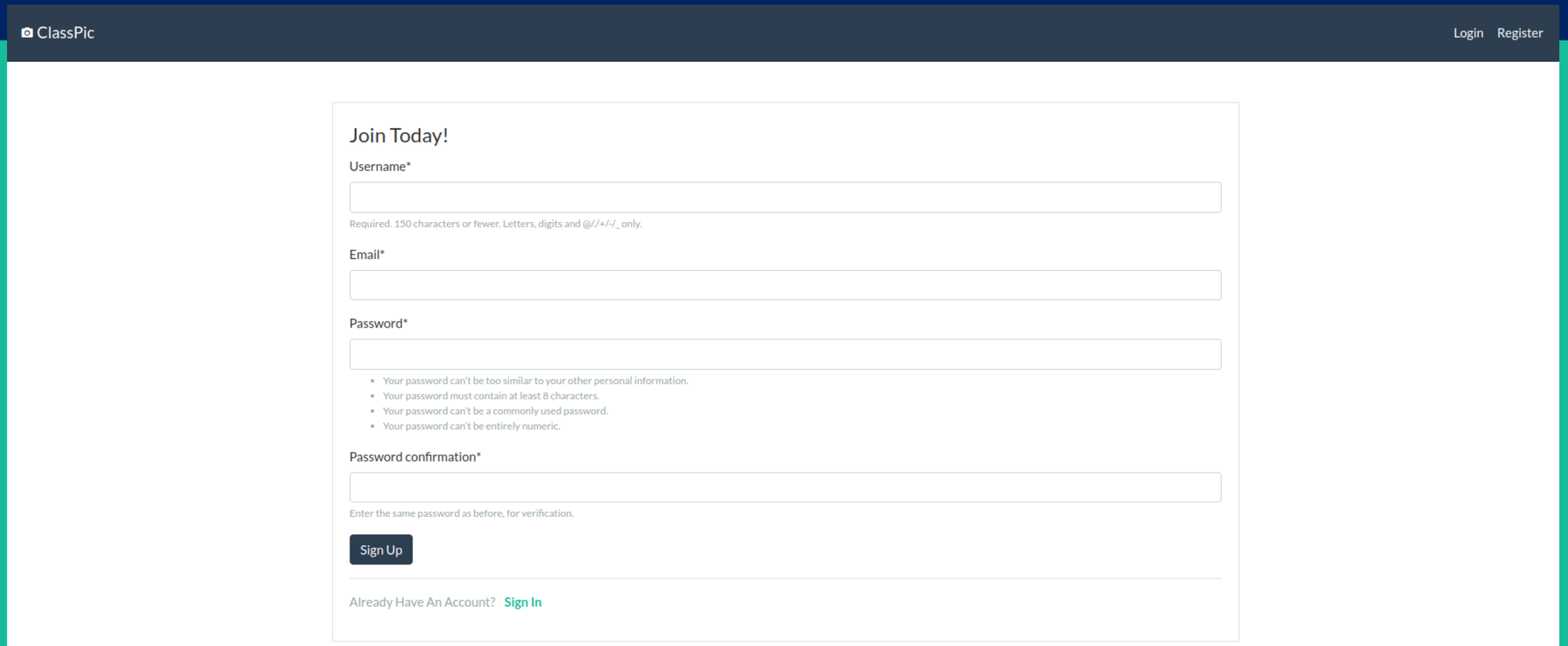
Login Page



RESULTS AND DISCUSSION

Web Application

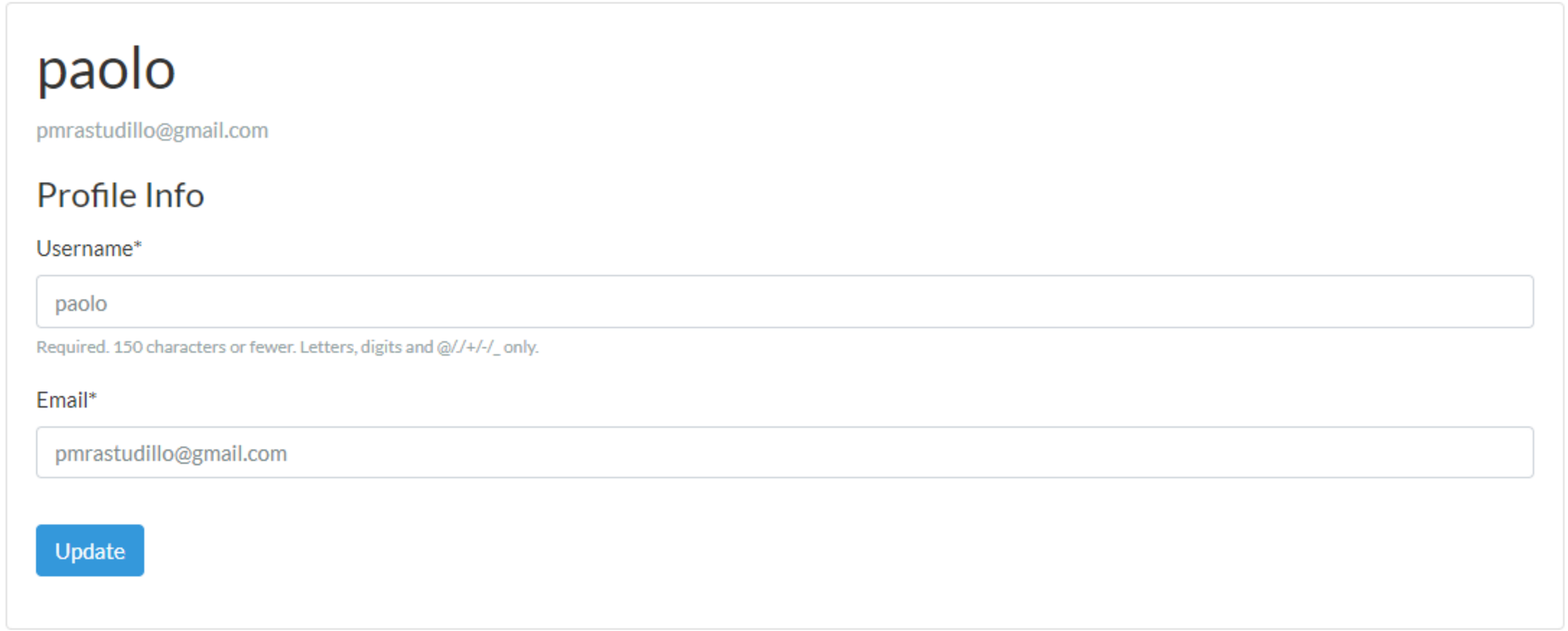
Register Page



RESULTS AND DISCUSSION

Web Application

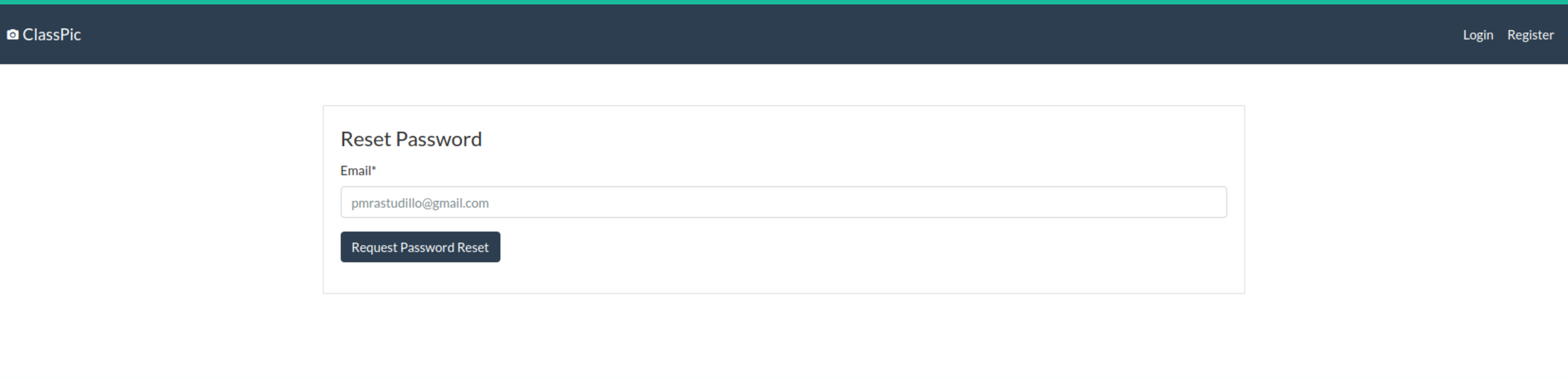
Profile Page



RESULTS AND DISCUSSION

Web Application

Forgot Password Page



RESULTS AND DISCUSSION

Web Application

Forgot Password Email

Password reset on www.classpic.dev Inbox ×

pmrastudillo@gmail.com
to me

You're receiving this email because you requested a password reset for your user account at www.classpic.dev.

Please go to the following page and choose a new password:

https://www.classpic.dev/password-reset-confirm/MQ/5gt-333fcde06064a60a4477/

Your username, in case you've forgotten: paolo

Thanks for using our site!

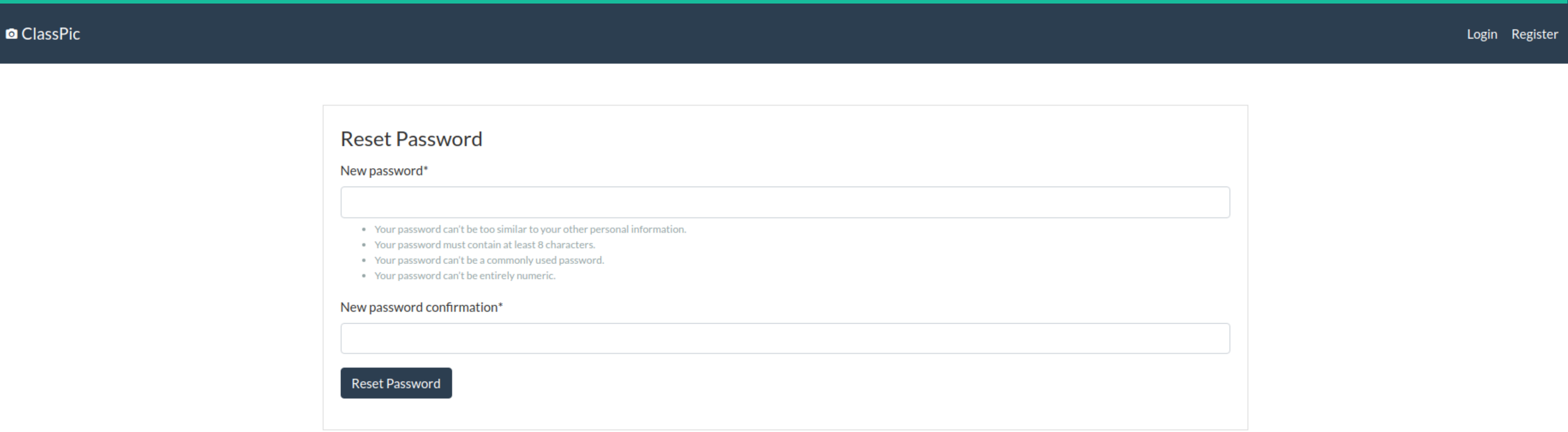
The www.classpic.dev team

Reply Forward

RESULTS AND DISCUSSION

Web Application

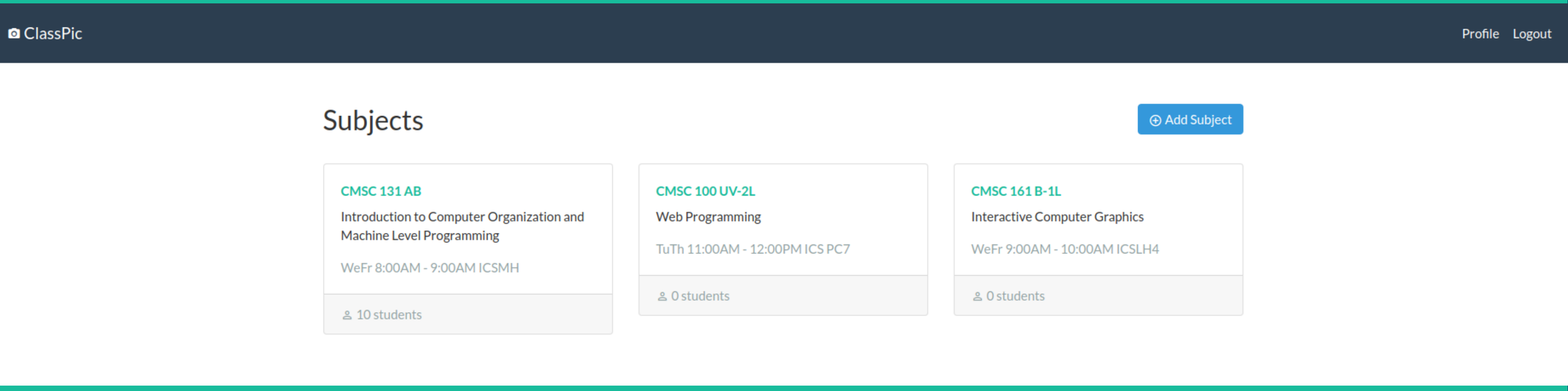
Forgot Password Form



RESULTS AND DISCUSSION

Web Application

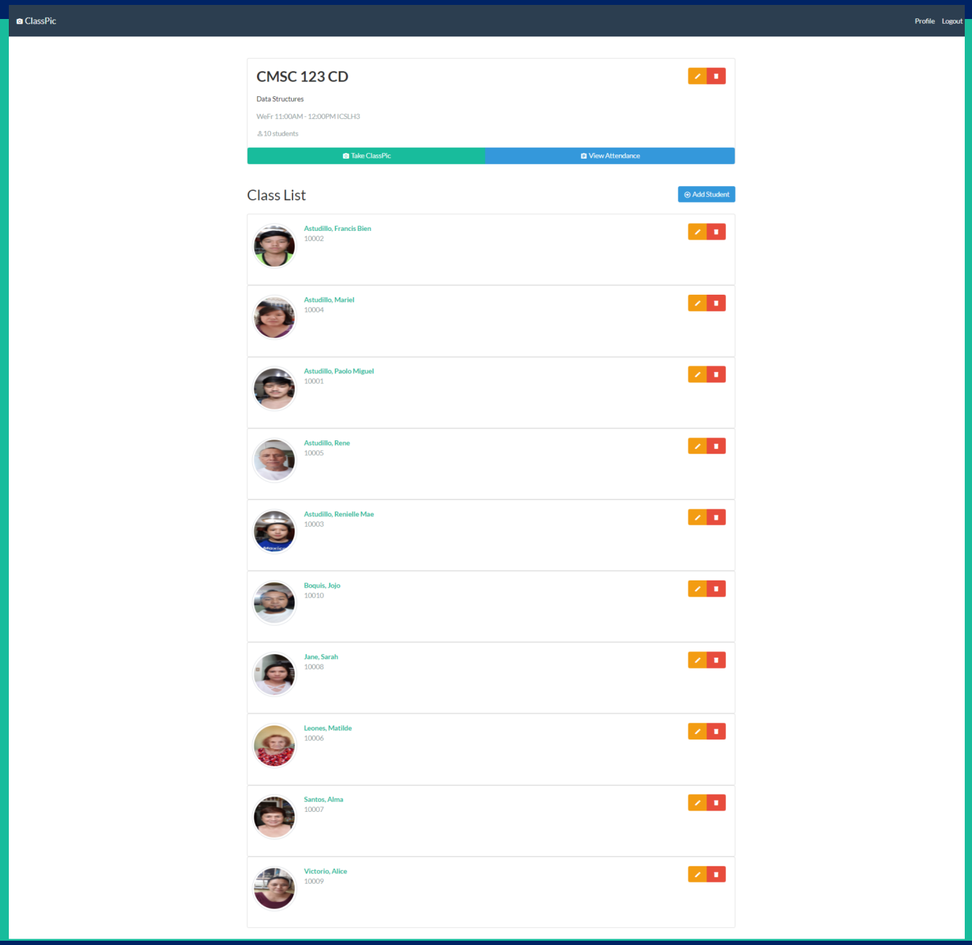
Dashboard Page



RESULTS AND DISCUSSION

Web Application

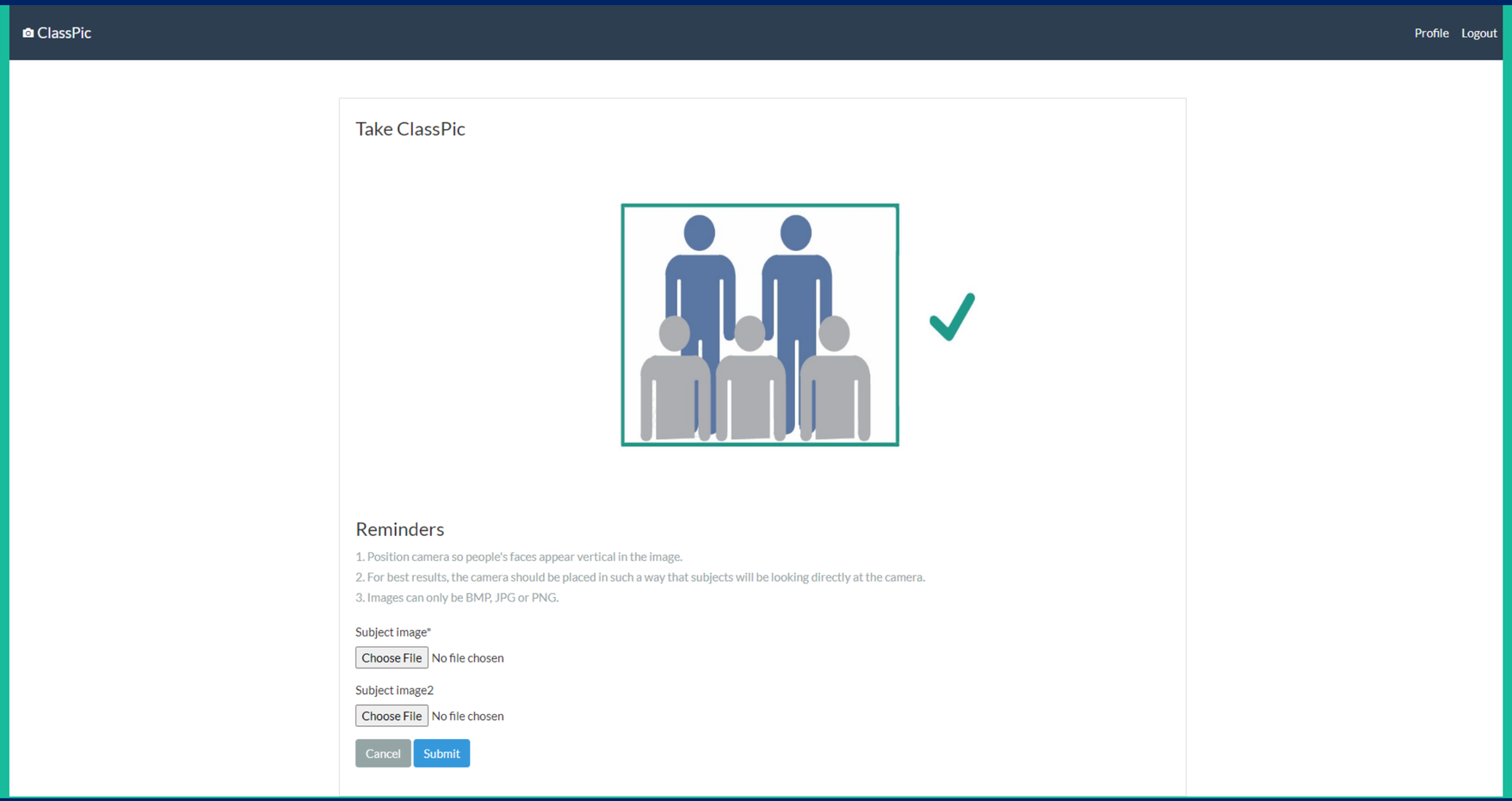
Subject Detail Page



RESULTS AND DISCUSSION

Web Application

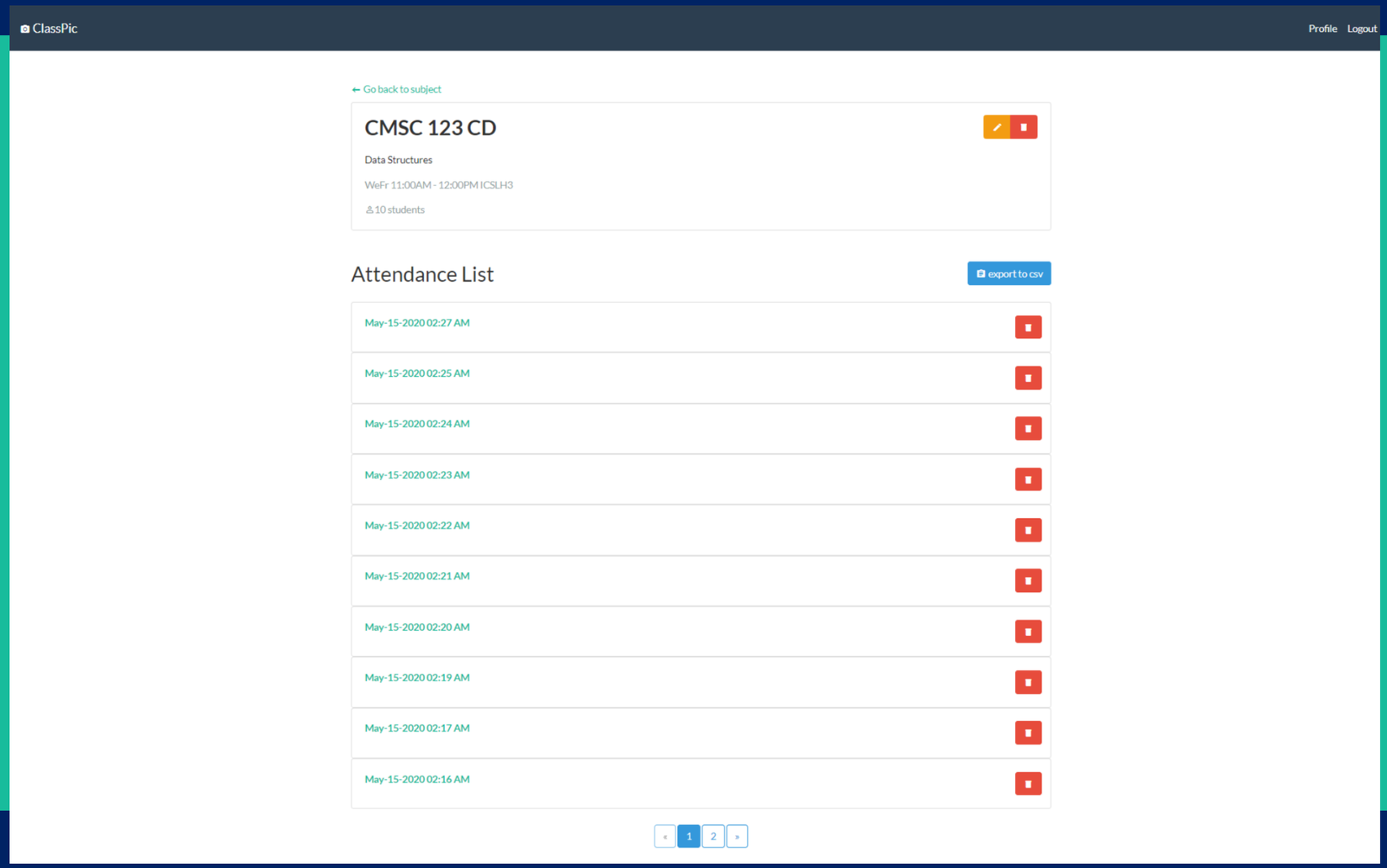
Take ClassPic/ Create Attendance Page



RESULTS AND DISCUSSION

Web Application

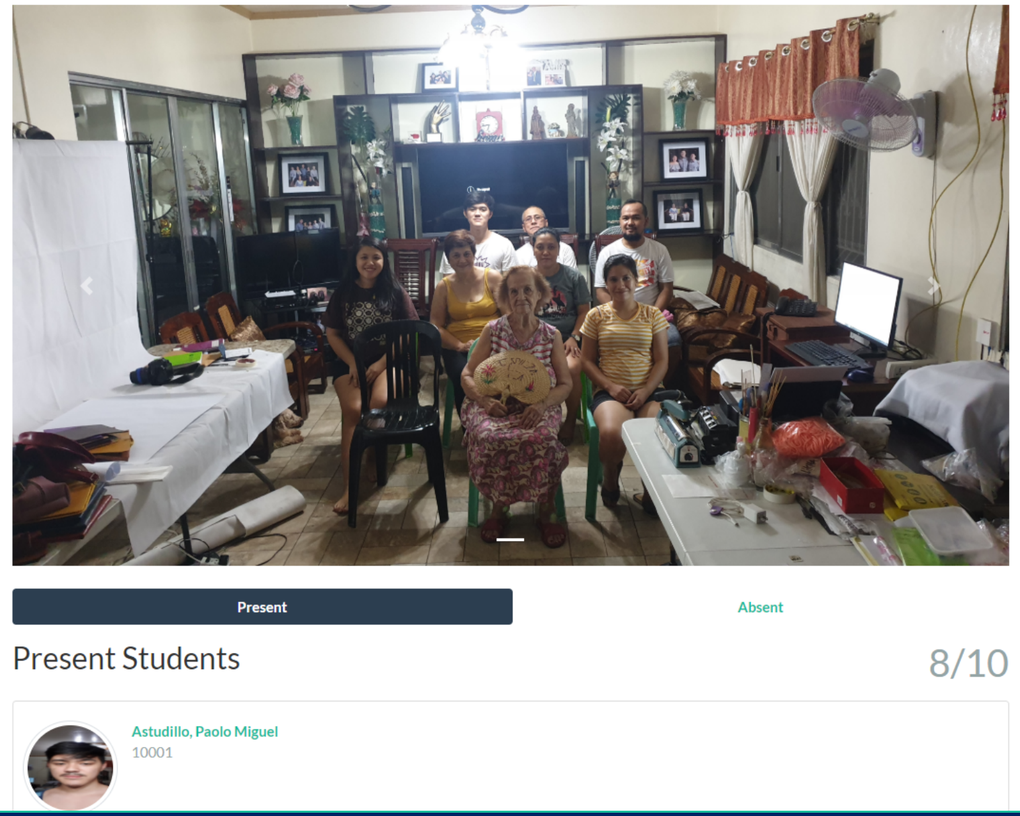
Attendance List Page



RESULTS AND DISCUSSION

Web Application

Attendance Detail Page



RESULTS AND DISCUSSION

Attendance Checking

- **Facial Hair/ Haircut does not affect recognition**
- **Eyeglasses do not affect recognition (except for sunglasses)**
- **"Sit-in" students or unenrolled students are not recognized**

No. of students=10, Automated Count=10

No. of students=10, Automated Count=10

RESULTS AND DISCUSSION

Attendance Checking

- **Can feed up to two pictures (for large classes)**

(a) Left side of the room: No. of students = 6

(b) Right side of the room: No. of students = 4 + 1 sit-in

No. of students=10 + 1 sit-in, Automated Count=10

RESULTS AND DISCUSSION

Attendance Checking

- **Low accuracy images caused by faces blocked by other students**

No. of students=10, Automated Count=6

RESULTS AND DISCUSSION

Attendance Checking

- **Low accuracy images caused by faces blocked by other students**

No. of students=10, Automated Count=9

RESULTS AND DISCUSSION

Attendance Checking

- **Satisfactory results are obtained when all faces are visible**

No. of students=10 + 1 Sit-in, Automated Count=10

No. of students=8, Automated Count=8

RESULTS AND DISCUSSION

Performance Issues

- **Due to time request limitations caused by a Heroku, a request which is greater than 30 seconds throws back a request timeout error.**
- **If a user has a slow internet connection the website will throw back a request timeout and attendance entity is not created.**
- **Commonly encountered if the user decided to upload 2 images in the take classpic form**

These errors are caused by:

- **Slow upload speed**
- **Kairos API /recognize can only cater one image per request**

These issues are not encountered when the website is in local machine

CONCLUSIONS AND RECOMMENDATIONS

- Attendance checking is an essential aspect of classroom management
- Status Quo of Attendance Checking
- Available technologies exist but expensive and require certain machinery
- Web application developed is more efficient, reliable and cost-effective
- Accuracy is satisfactory given the optimal conditions are met such as all of the faces are visible

Future works include:

- Using another API or developing new facial recognition algorithm to improve accuracy
- Fixed phone mounted to take class picture at a certain time to detect late students and remove hassle of taking pictures
- Integration to existing classroom management platforms such as Google Classroom and Edmodo

THANK YOU!

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