A
Project report
On

“Face Recognition for Online Exam”

Submitted in partial fulfillment of
The requirements for the diploma of

Computer Engineering

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Certificate

*The project report entitled **"Face Recognition for Online Exam"** is a bonafide work carried out in Sixth semester in a partial fulfillment of the requirements for diploma in computer engineering from Government Polytechnic, Khamgaon during the academic year 2020-21.*

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The real spirit of achieving a goal is through the way of excellence and lustrous discipline. I would have never succeeded in completing my task without the cooperation, encouragement and help provided to me by various personalities.

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Abstract

The development of the small-scale industry in the development of an area is very important, mainly about employment opportunities and income for the community. In The European Union's country members, small and medium-sized enterprises (SMEs) play an essential role in economic life, having special features that make adaptation process to the contemporary economy easier. Small and medium sized enterprises (SMEs) are the most dynamic and vital factor of progress in the contemporary society, main generator of economic performance and substance in any country, employment opportunity provider for most of population, major contributor to the national budget, and engine to improve the living standard of the population. SMEs represent 99% from all enterprises, drawing up the main human resources aglomeration.

CHAPTER 1

1. Introduction

Artificial intelligence and Machine Learning have gained increasing popularity in recent years due to their ability to handle tasks that would otherwise take too much computational power, and due to their versatility, the wide range of problems they have been shown to solve. One of the most well-known tasks that machine learning has made possible is face recognition. Face recognition technology has been used for a variety of applications including automatic tagging in Facebook photos, Snapchat lenses that overlay dog ears on someone's head, and security and surveillance, with the more recent capacity to track individuals moving throughout a closed space as they cross in front of security cameras.

Face is our primary focus of interaction with society, face communication identity, emotion, race and age. It also quit useful for judging gender, size and perhaps even character of person. However, it also used to identify people to various places through face recognition for authorization.

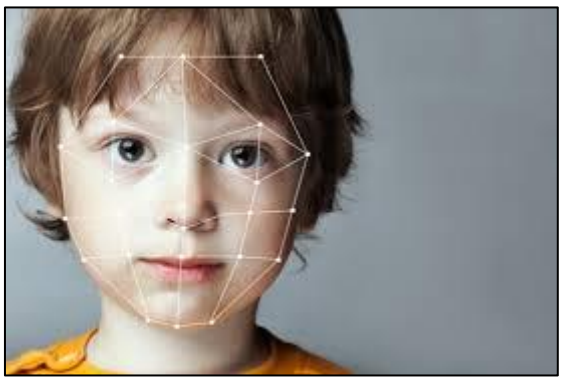


Fig 1.1: Face Recognition

Facial recognition systems rely on unique facial features as an additional layer of security to identify and distinguish people whether they are new faces or old ones in a database. We set out to apply this technique to the field of internet security, along with Captcha's, I'm not a robot checkboxes, security questions, two factor authentication, and many others. Facial

recognition has the potential to be a much simpler approach to security than remembering additional security information or connecting other accounts and devices.

The face detection or recognition is one of the most popular researches in the computer system, and it is the most advanced and better application to analyses the images which are algorithm based technology. Face recognition mainly formulated as the still images, identifying one or more images that are stored in the database management. Face detection is taken as the more successful and advanced technology in a computer system nowadays. It will detect the exact location and the faces of the human being which is stored in the digital images.

At this time the exam system that takes place in the online runs manually, where students comes to carry out the test according to the time specified it is not efficient because more and more online students are scattered in several regions. The aim to be achieved in this study is to make a prototype of an online exam application design in order to recognize Students who will take the exam with face recognition methods. The benefits generated in this study are expected to overcome the weaknesses of student absenteeism which currently runs manually on Online and prevents misuse of the existing attendance system, for example occurs with attendance manipulation by entrusting accounts / logins to other students or other people.

As for the expected results in the design of this exam application prototype:

- Perform feature extraction process used in face recognition
- Learn the basic principles of facial recognition using the Eigen Face method
- Computerize student attendance so that it is more valid and easier in controlling.

1.1 Overview

Face detection is an important first step for applications in several areas, including biometrics, human-computer interfaces, and surveillance. Nowadays, the importance of the automatic face detection and tracking system has increased as it is needed for video surveillance and new user interfaces. The goal of this research effort is to construct a face detection system using a webcam in real-time.

1.2 Background

Artificial intelligence and Machine Learning have gained increasing popularity in recent years due to their ability to handle tasks that would otherwise take too much computational power, and due to their versatility, the wide range of problems they have been shown to solve. One of the most well-known tasks that machine learning has made possible is face recognition. Face recognition technology has been used for a variety of applications including automatic tagging in Facebook photos, Snap chat lenses that overlay dog ears on some one's head, and security and surveillance, with the more recent capacity to track individuals moving throughout a closed space as they cross in front of security cameras . Facial recognition systems rely on unique facial features as an additional layer of security to identify and distinguish people whether they are new faces or old ones in a database. We set out to apply this technique to the field of internet security, two factor authentications, and many others. Facial recognition has the potential to be a much simpler approach to security than remembering additional security information or connecting other accounts and devices.

CHAPTER 2

2. Literature Survey

Face verification is a process of recognizing and matching faces. The use of biometrics for recognition systems has the aim of increasing human comfort and security in the scope of personal privacy and in a wider scope such as for an agency, the advantages of biometrics have many benefits and advantages compared to traditional systems such as: manual signing, use of passwords, PINs, cards and the key that has been applied to: entrance access, attendance, ATM machines and others. Face detection is a great study in the computer vision. In olden days i.e. (before 2000) many studies and practical performances of the face detection was not satisfied until Viola and Jonas proposed a work. The first who are applying rectangular boxes for faces but it has lots of drawbacks as its features size was large. In a 24 X 24 image, the total number and also it is not handled for wild faces and frontal faces.

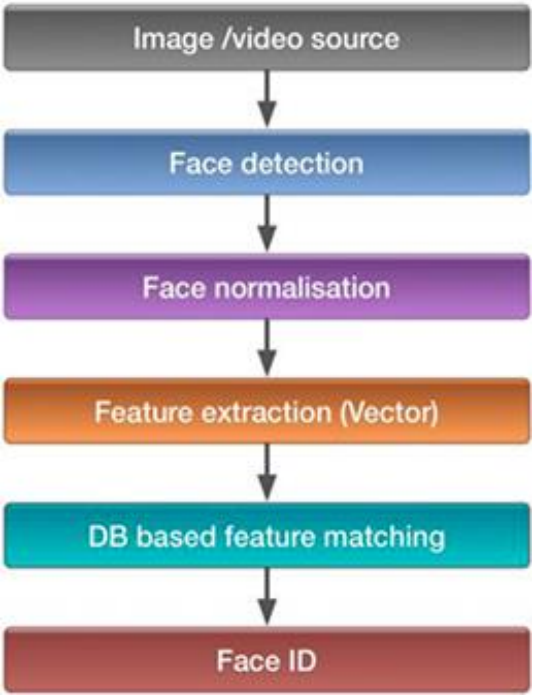


Fig 2.1: Face Recognition Process

First we get image/video source then it will detect face after detecting face normalization the face extraction is done within vectors afterwards it matches extracted face with face stored in

database, this is how face recognition will process further. It is a computer technology that determines the location and size of human face in arbitrary (digital) image. The facial features are detected and any other objects like trees, buildings and bodies etc are ignored from the digital image. It can be regarded as a specific case of object-class detection, where the task is finding the location and sizes of all objects in an image that belong to a given class. Face detection, can be regarded as a more general case of face localization. In face localization, the task is to find the locations and sizes of a known number of faces (usually one). Basically there are two types of approaches to detect facial part in the given image i.e. feature base and image base approach. Feature base approach tries to extract features of the image and match it against the knowledge of the face features. While image base approach tries to get best match between training and testing images.

2.1 Problem Definition

However, there's an obvious issue with using facial recognition to login to your account. Anyone with you picture can log into it too. Furthermore, if anyone hacks the site, they may gain access the database of face data and be able to relate user accounts to actual faces, then do some reverse processing to label those faces with real names rather than whatever alias may have been their username. And is facial recognition even accurate enough to avoid false positives and log someone into the wrong account? Can someone just sit in front of a camera long enough to get sneak past a sites security? Apple has provided a solution to solve this photo trick by relying on dual cameras and an array of projected infrared dots to detect depth in its new facial recognition system. However, such a solution is limited to devices with expensive hardware upgrades and can't be applied to lower cost applications. Higher costs often limit other improvements, complicate manufacturing, and raise the price for consumers. Several institutions of higher learning are using proctored exams to prevent candidates from cheating. However, no technology is fool proof. Students can still cheat during an online proctored exam. Below are some of the technical and non-technical ways candidates can cheat during an online proctored exam.

Most of the exams that are given to students during online tests are usually multiple-choice tests. This is because they take lesser time than open-ended questions or tests requiring students to come up with essays in response to questions

In such a case, there are various ways in which students can cheat on online multiple-choice tests without getting caught. They can even do this during an online proctored exam.
Now that we have discussed the most common methods used by students to cheat during online tests, many students have noticed that proctoring technologies are used to combat several forms of online cheating.

Fig 2.2: Student's Friends giving his exam in absence of Student

When it comes to conducting online exams, most educational institutions are faced with the problem of cheating by students. Universities and colleges are now embracing online courses and students have taken this as an opportunity to cheat during online tests. This is because the students take those tests while at their remote locations and it is difficult for the institutions of higher learning to monitor the activities of their online students.

2.2 Proposed Methodology to Solve Identified Problem

To overcome the problems in the existing Exam system we shall develop face recognition over simple Exam login. There are many solutions to login the Exam like entering password, thumb-based system but all these systems have limitations overwork and security point of view. Our proposed system shall be a "Face Recognition for Exam Login" which uses the basic idea of image processing which is used in many security applications like banks, airports, Intelligence agencies etc. The ability to recognize faces is very important

to many aspects of life. Facial recognition is a powerful technology but it has to be used wisely. It brings immense advantage to the companies, college students and end-users, helps them enhance their security and track down the trespassers and also Facial recognition can help identify terrorists or any other criminals with the help of the face scan only. The additional bonus is the fact that one cannot hack the technology: there is nothing to steal or change, like in case of a password, for example, as for personal use, facial recognition can be used as a security tool for locking personal devices and for personal surveillance cameras.

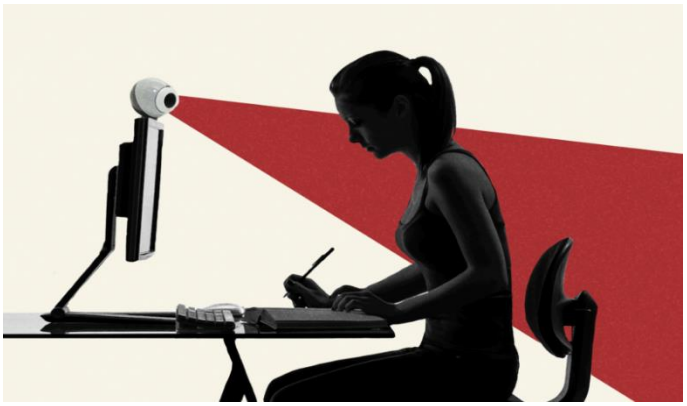


Fig 2.3: Student must be here to conduct Online Examination

To address the issues of impersonation, we propose a system that would use a video stream, rather than a still image, to check that the correct person is logging in. if our facial recognition detects a video frame without the correct matching face, the login step will fail. However, such a system could be spoofed by simply holding a video up to the camera, so we will also ask the user to perform some random gesture to ensure it's a real person in front of the camera. Our solution is pure software-based, requiring no additional hardware expenses, and can be applied to a wide range of applications including building security, unlocking cellphones, and website logins. The reliability and ease of use of our system will be reliant on the accuracy of the facial recognition and the set of gestures available to use.

CHAPTER 3

3. Scope of the Project

Though there are some weaknesses of facial recognition system, there is a tremendous scope in India. This system can be effectively used in ATM's, identifying duplicate voters, passport and visa verification, driving license verification, in defense, competitive and other exams, in governments and private sectors. Facial recognition has many benefits in society, including increasing safety and security, preventing crimes, and reducing human interaction. It can even help support medical efforts, in some cases.

When it comes to responding quickly to terrorist attacks, facial recognition can support security staff by providing them with increased visibility and situational awareness. Facial recognition can also help prevent future attacks when it is integrated into the post-event investigative workflow.

CHAPTER 4

4. System Requirements

4.1 Hardware Requirement

Processor	Intel Processor i3 or above
Ram	Minimum 8.00 GB and more
Hard Disk	2 GB minimum
Monitor	Color Monitor (16 bit above)
Web Camera	Wireless
Input and Output Devices	

4.2 Software Requirement

Operating System	Windows 7 or more
Application Software	PyCharm, MySQL
Latest versions of all libraries of Python	Sip, Pandas, Pickle, Sklearn, NumPy, etc.

4.3 Functional Requirements

- A user must be able to manage student record.
- A system must attach to wireless camera and face recognizing should be smooth.
- The information must be enter and manage properly.
- A person who will be given the access to the system must login into the system before using it.

4.4 Non Functional Requirements

- The GUI of the system must be user friendly.
- The system will be extended to the changes.
- Efficiency and Effectiveness of the system will be made sure.
- Performance of the system made sure.
- The data that will show by user make sure that is correct. System must be flexible to changes.

4.5 User Requirements

- User needs to entire the proper detail while registering him/her.
- At the time of face recognition student need to seat properly facing the camera.
- He / She needs to seat properly and capture images himself/herself .

4.6 Design Constraints

- Uses computer camera
- Uses video
- Web based platform
- Camera frame speed

The constraints are limiting factors of our system, which in our case is mostly technology. Since we are building a login system for websites, the APIs and other software tools need to work well with websites. We also expect that everyone will be logging in with a computer (we aren't supporting phones for this project), so our facial recognition needs to work in poor lighting conditions and without relying on expensive camera features.

CHAPTER 5

5. System Use Cases

The use case represents the list of actions and event steps which define the interactions among users, websites, and the API.

5.1 User

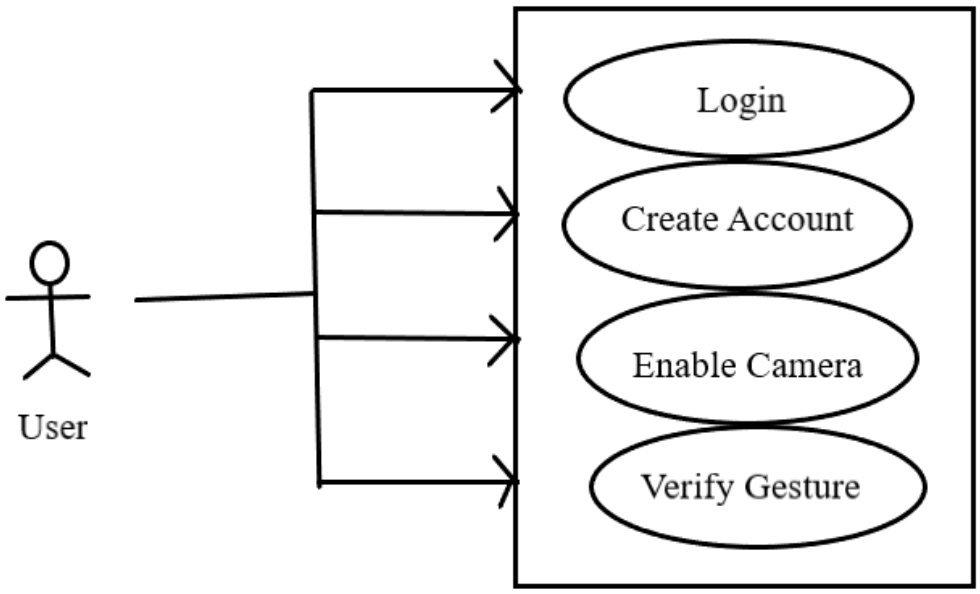


Fig 5.1: Use Case Diagram of the User

Use Case 1: Login

- Name: Login
- Goal: Provide user access to the system
- Actor: User
- Pre-conditions: – The user has an active connection to website 11 – The user has previously signed up – The user knows his or her username
- Steps: – The user types in the username – The user clicks ”verify” – The system recognizes the user’s face and verifies that he or she is a real person

- Post-conditions: – The user's username has been verified in the system
- Exception: The user enters invalid username

Use Case 2: Create account

- Name: Create account
- Goal: Provide user access to the system
- Actor: User
- Pre-conditions: – The user has an active connection to website
- Steps: – The user types in the username – The system takes some photos of the user. The system stores the pictures and username in the database
- Post-conditions: – The user's account is created
- Exception: N/A

Use Case 3: Enable camera

- Name: Enable camera
- Goal: Provide the camera in user's computer access to record user's face
- Actor: User • Pre-conditions: – User's username has been verified
- Steps: – The system pops out a request to enable camera – The user clicks "yes"
- Post-conditions: – The camera is enabled
- Exception: The computer does not have a camera

5.2 Website

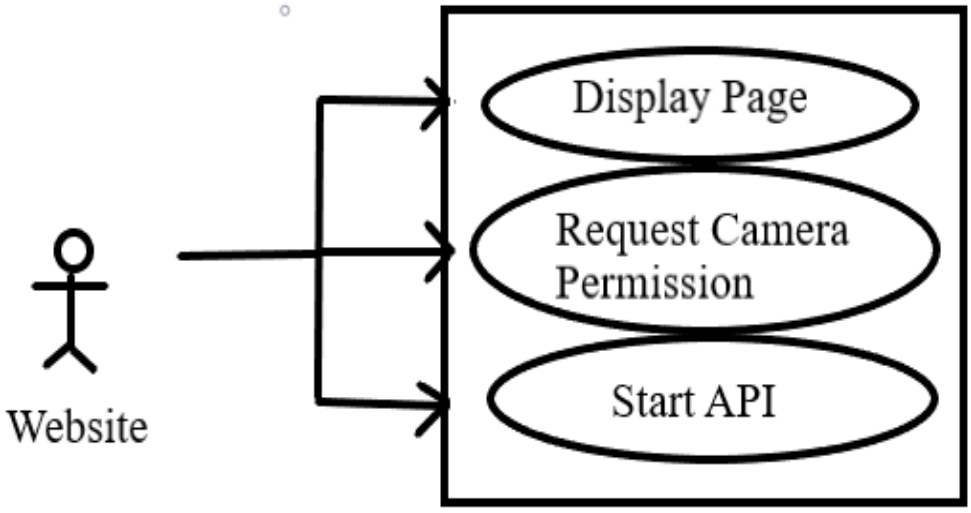


Fig 5.2 Use Case Diagram of the Website

Use Case 4: Capture Image

- Name: Capture Image
- Goal: Verify whether the user is a real person or a photo
- Actor: User
- Pre-conditions: – The user enters valid username – The user's camera is enabled – The user's face has been detected by the system
- Steps: – The system displays a certain gesture for the user to perform – The user perform the gesture – The system analyze the user's gesture
- Post-conditions: – User successfully login
- Exception: The user performs wrong gesture

Use Case 1: Display page

- Name: Display page
- Goal: Provide user access to the page in browser
- Actor: Website

- Pre-conditions: – The user has an active connection to website – The browser is compatible to the user's computer
- Steps: – Read HTML, CSS, and JavaScript files – Execute python files to make operations with server • Post-conditions: – The page is successfully displayed
- Exception: 404 Not Found

Use Case 2: Start API

- Name: Start API
- Goal: Retrieve information using API technologies
- Actor: Website
- Pre-conditions: – The page is successfully display – User is interacting with the system
- Steps: – The system send a request to other websites using API to request information – The system receives responses from other websites
- Post-conditions: – The result is successfully return by the API
- Exception: The API does not work

Use Case 3: Display user profile

- Name: Display user profile
- Goal: Provide user permission to see his or her information
- Actor: Website
- Pre-conditions: – The user is successfully logged in – The user's browser is compatible with his computer
- Steps: – The system user's information from the database – The system lists the information on the web page
- Post-conditions: – User's information is successfully displayed
- Exception: Database connection error

5.3 API

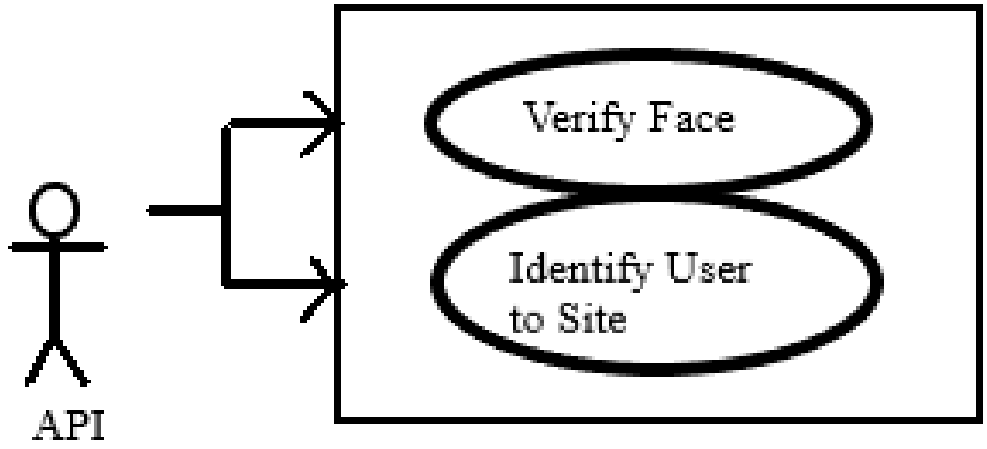


Fig 5.3: Use Case Diagram of the API

Verify Face

- Name: Verify face
- Goal: Recognize user's face in the camera
- Actor: API
- Pre-conditions: – The user's camera is enabled
- Steps: – Separate the camera video into multiple frames – Use pre-trained machine learning model to check if there is a face in the frame – Draw bounding box around the face detected
- Post-conditions: – User's face is successfully detected
- Exception: User's face is not found

Verify Gesture

- Name: Verify gesture
- Goal: Test if the user is real
- Actor: API
- Pre-conditions: – User's face is detected 15

- Steps: – The system displays a specific gesture on the screen – The user perform the gesture accordingly – The system verify is the gesture is correct
- Post-conditions: – The gesture is verified and user is logged in
- Exception: User performs wrong gesture

Identify user to site

- Name: Identify user to site
- Goal: Map user's face with those in the database
- Actor: API
- Pre-conditions: – The user's face is detected
- Steps: – Search the database – Pick the user in the database with the most similar picture as the login user – return the user's information
- Post-conditions: – User is found in the database
- Exception: Database connection error

CHAPTER 6

6. Methodology

6.1 Development Methodology

Development methodology to be used in this research is Waterfall Software Development Life Cycle (WF-SDLC). Since this is a security system that combines surveillance system and facial expression technologies to come up with a real-time intelligent surveillance security system we have seen the need to add collaborative methodology to the WF-SDLC because it isn't enough for the WF-SDLC to work alone in a collaborative system. Therefore the system will be designed following the Collaborative Waterfall Software Development Life Cycle. This system is developed in a way that it will be able to detect the person's facial expression helping the guards to foresee if the person can cause harm to other people or he has any bad intentions of committing prohibited work. The WF-SDLC methodology follows six main phases, that is: Planning, Analysis, Design, Implementation and Maintenance.

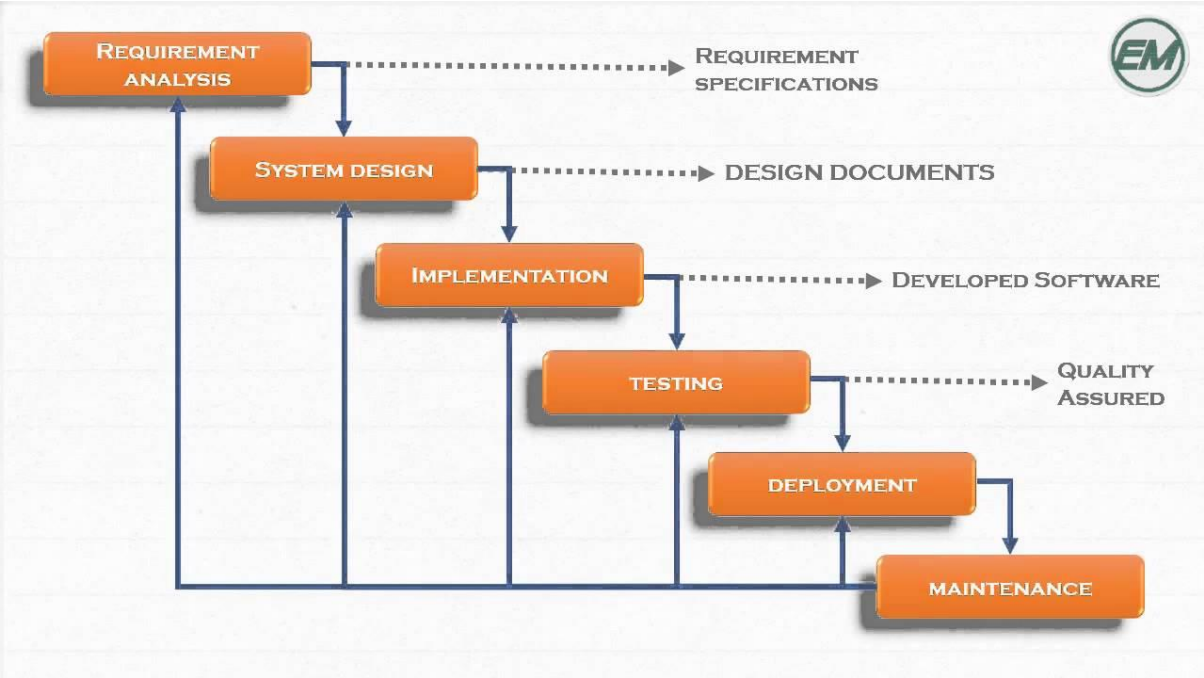


Fig 6.1: Waterfall Model (SDLC) used for System

6.2 System Requirements Phase

The purpose of this phase is to determine project's main goal and how the system will function. To gather system requirements information, these are common questions that have to be answered:

- Why the system needs to be developed?
- Who are the users?
- How will they use the system?
- What are they using the system for?
- What are the input and output of the system?

This question needs to be answered thoroughly to come up with clear functionality of the system describing the functions that the system should perform. All possible requirements of the system to be developed are captured in this phase. After the requirements are understood Software Requirement Specification (SRS) document is prepared to serve as a guideline for the next phase of the model.

6.3 Analysis Phase

In this phase analysis of the user's requirement is carried out. This is to determine the scope of the users based on the SRS prepared in the requirement phase and the observations made on the current systems. Thing to be cogitated are

- Scope of users
- Purpose of the system
- Information on surveillance systems
- Suitable equipment's (camera, laptop etc.)

The overall purpose of the analysis phase is to define the project goals that have been determined in the requirements phase into defined functions and operation of the intended system. It analyses end-user information needs.

6.4 Design Phase

This is the plan of how the system will look like and how it works. It describes the desired features and operations in detail and may include screen layouts, process diagrams,

pseudocode and other documentation. A sample of the project is developed in this phase. Design focuses on high level design like, what programs are needed and how are they going to interact, low-level design (how the individual programs are going to work), interface design (what are the interfaces going to look like) and data design (what data will be required). During these phases, the software's overall structure is defined and the logical system of the product is developed in this phase. It also helps in specifying hardware and system requirements and also helps in defining overall system architecture.

6.5 Implementation and Unit Testing Phase

This phase is considered to be the longest phase of the software development life cycle. This is so because this is where the code is created and work is divided into small programs that are referred to as units. This phase include unit testing whereby units will be tested individually for their functionality before the whole system. Unit testing mainly verifies if the modules also known as units meet project specifications.

6.6 Testing Phase

This is the main testing phase in the SDLC, as the project is divided in small modules in the previous phase then the modules will be integrated together to test the system as whole. This is to make sure that the modules work together as intended by the developer (as in the specifications) and required by users. It also checks for bugs, errors and ensure the system is able to work in the intended platform. After ensuring that the product had solved the problem the system is then delivered to the customers.

6.7 Maintenance/Operation Phase

Not all problems can be seen directly, but they occur with time and as other problems they needs to be solved. Usually these kinds of problems come in picture after the practical use of the system they are never found throughout the development life cycle. This phase of the Waterfall Model is considered to be very long, it never ends. The changes that occur after the product is handed to the users must not affect the main operation of the system, so a system must be developed in a way that it will adapt to change.

CHAPTER 7

7. Design Rationale

7.1 Programming Languages

- **Python**

Python is used for back end operations such as training machine learning models and retrieve information using the Facial Recognition API.

- **Django**

Django is a python Web frameworks, which supports the development of the web API. Django is a high-level Python Web framework that encourages rapid development and clean pragmatic design. Django's primary goal is to ease the creation of complex database-driven websites. Some well-known sites that use Django include PBS, Instagram, Disqus, Washington Times, Bitbucket and Mozilla.

- **HTML5**

HTML5 is used to create documents on the web page. It defines the structure and layout of a Web document by using a variety of tags and attributes.

- **CSS**

CSS is used to describe the presentation of Web pages. It also makes the web page responsive to different devices.

- **JavaScript**

JavaScript is used as a client side scripting language. Its code is written into an HTML page. When a user requests an HTML page, the script is sent to the browser.

- **SQL**

SQL is used to communicate with a database. As the standard language for relational database management systems, SQL statements are used to perform tasks such as update data on a database, or retrieve data from a database.

7.2 Applications

- **Python**

Python is used for back end operations such as training machine learning models and retrieve information using the Facial Recognition API.

- **MySQL**

MySQL is a self-contained, high-reliability, embedded, full-featured, public-domain, SQL database engine. It is used to store both account information and pictures of the users.

- **Visual Studio Code**

Working with Python in Visual Studio Code, using the Microsoft Python extension, is simple, fun, and productive. The extension makes VS Code an excellent Python editor, and works on any operating system with a variety of Python interpreters.

7.3 Facial Recognition

API We opted to use a deep neural network for the machine learning part of facial recognition because it is the most appropriate model to solve unconstrained classification problems, especially when distinguishing class characteristics aren’t known. Furthermore, we were able to find an open source and free to use software package for facial recognition that used that had already been trained on a large dataset, so we didn’t have to build and train our own.

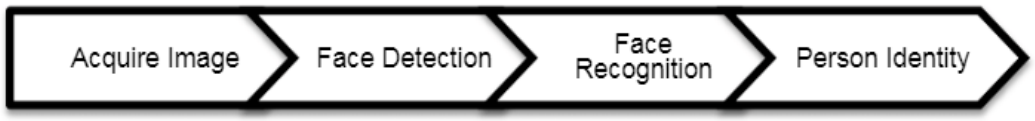


Fig 7.1 Steps for Face Recognition System Application

7.4 Labeled Faces in the Wild

The face recognition API we use scored 99.38% on Labeled Faces in the Wild benchmark (a database of face photographs for studying unconstrained face recognition). The machine learning model was trained on a wider and more diverse image set than we could have prepared ourselves.

7.5 Accuracy Threshold

The accuracy rating suggests that we should expect 99% of each frame to correctly indicate whether the face matches the correct user. That's still not good enough, especially if we want to speed up the gesture recognition, since a single false detection restarts the gesture process. To reduce the risk of these annoying users, we've lowered the threshold for matches to shift errors towards false positives. The API is still good enough at detecting true negatives among all the video frames, so imposters can't access another's account.

CHAPTER 8

8. Details of Design, Working and Process

A throughout survey has revealed that various methods and combination of these methods can be applied in development of a new face recognition system. Among the many possible approaches, we have decided to use a combination of knowledge-based methods for face detection part and approach for face recognition part. The main reason in this selection is their smooth applicability and reliability issues.

8.1 Class Diagram

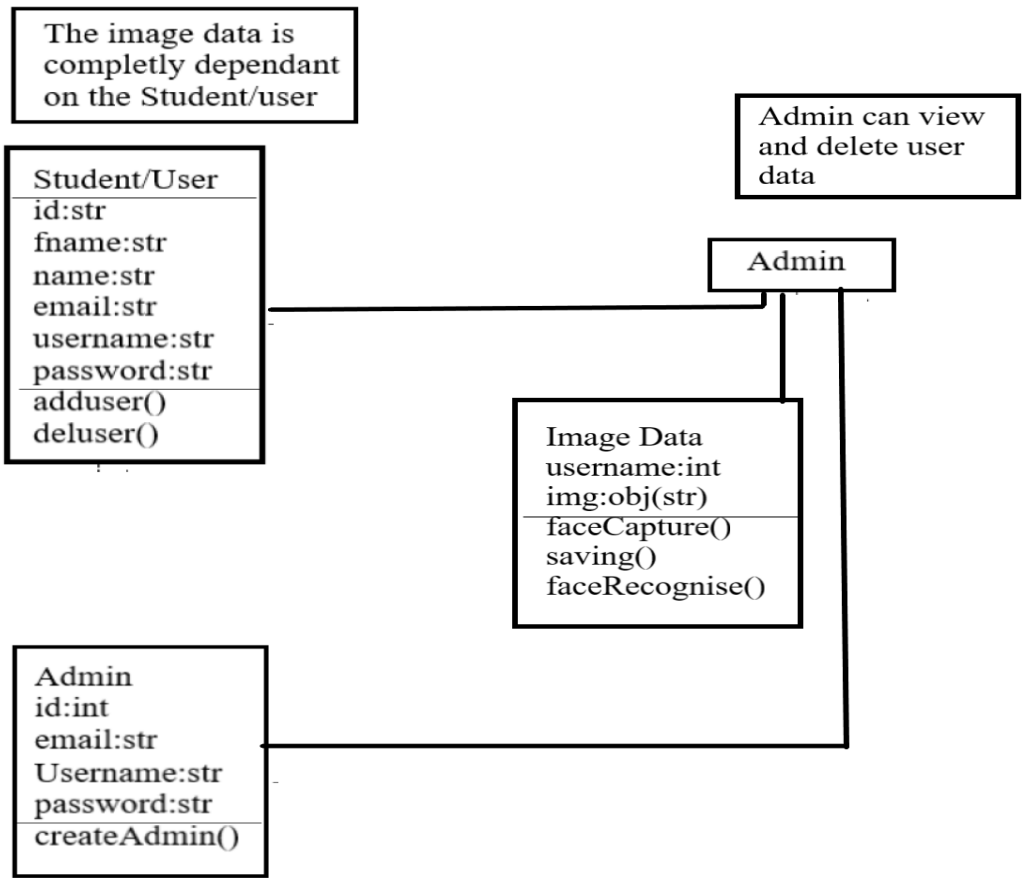


Fig 8.1: Class Diagram of Website

8.2 Activity Diagram

8.2.1 High Level View of User Operations

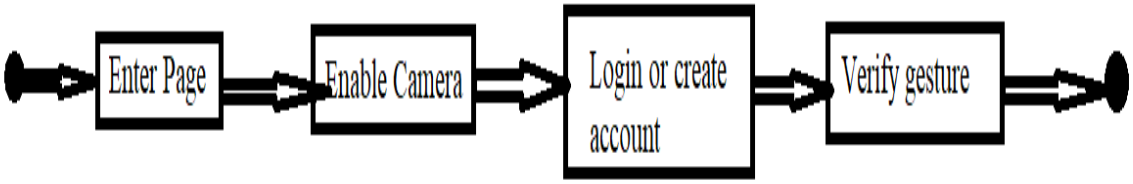


Fig 8.2: Activity Diagram for High Level View of User Operations

8.2.2 High Level View of Website Operations

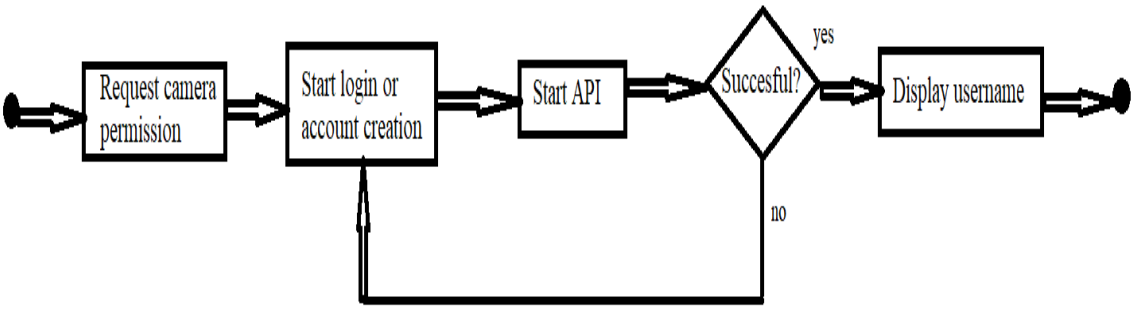


Fig 8.3: Activity Diagram for High Level View of Website Operations

8.2.3 High Level View of API Operations

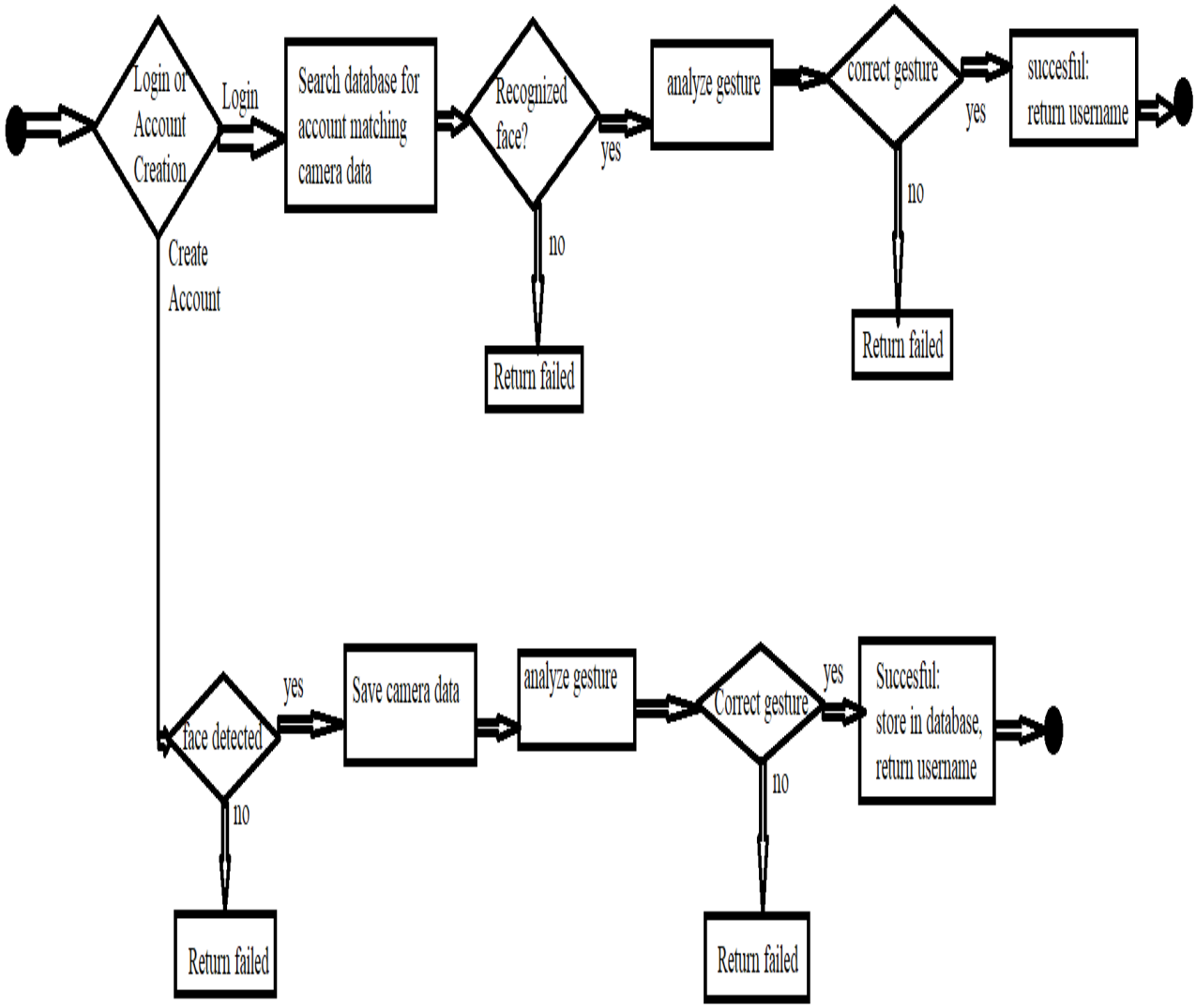


Fig 8.4: Activity Diagram for High Level View of API Operations

8.3 State Transition Diagram

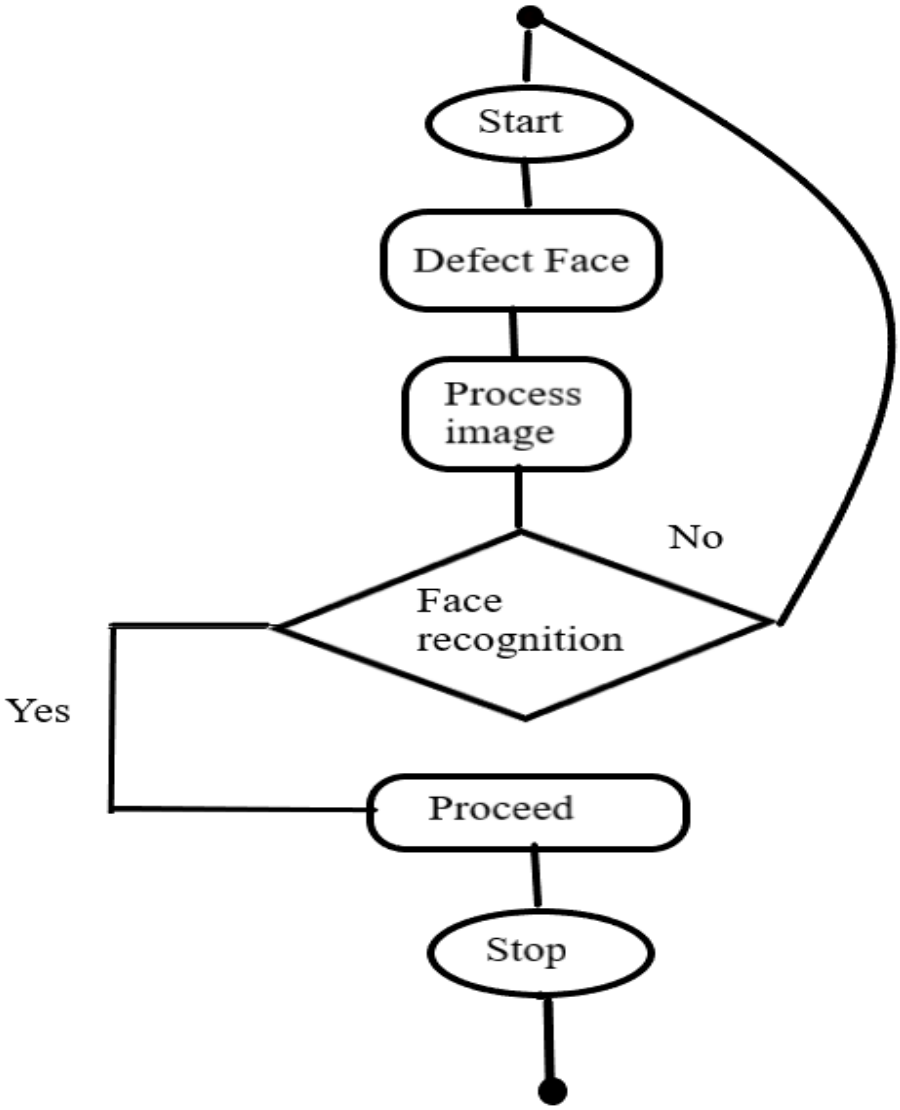


Fig 8.5: State Transition Diagram

8.4 Sequence Diagram

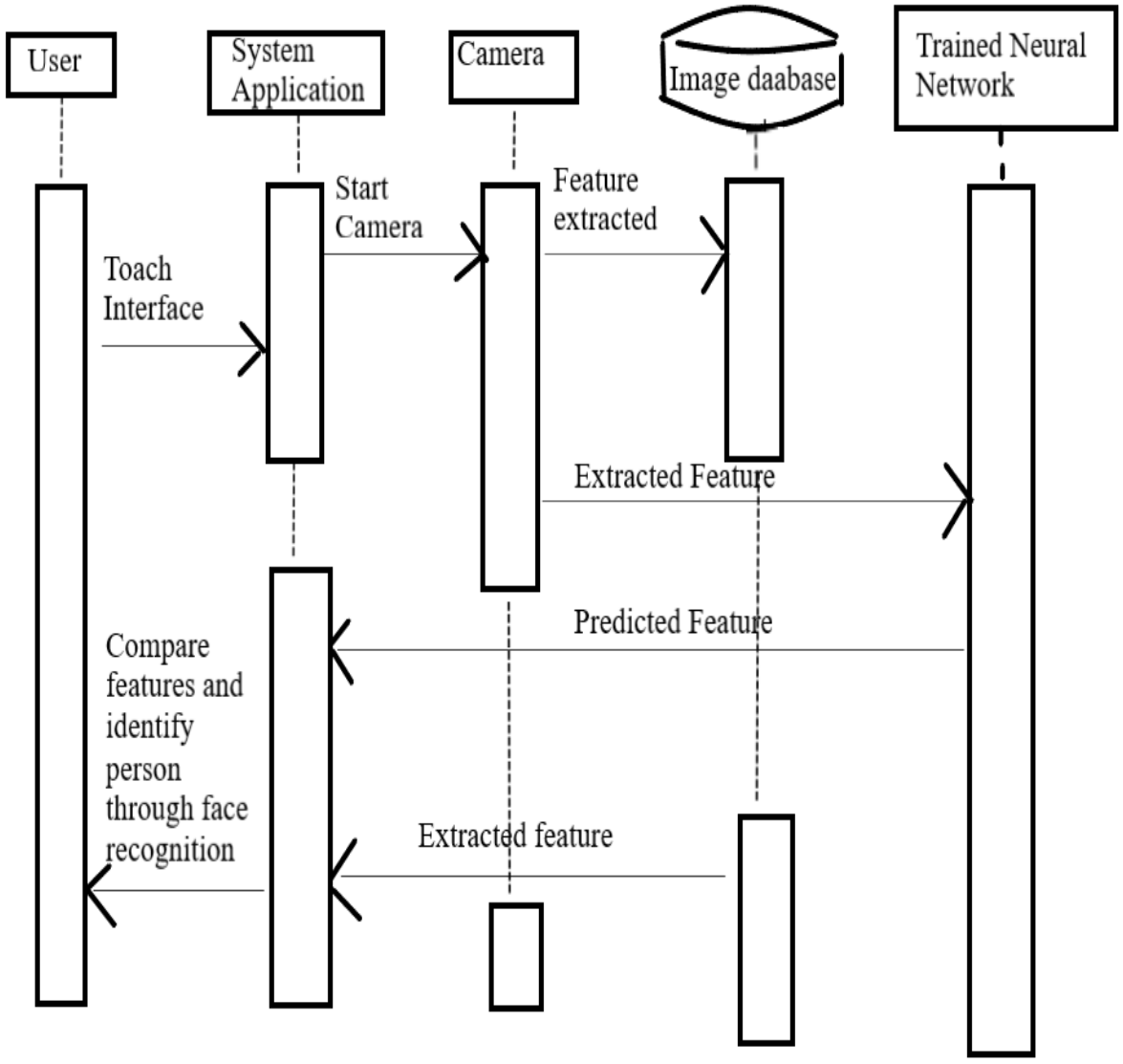


Fig 8.6: Sequence Diagram

CHAPTER 9

9. Implementation and Testing

9.1 Implementation

The proposed system needs the following libraries to be setup before implementing it. The libraries that need to be configured are:

- OpenCV Python

OpenCV is a Python library that is designed to solve computer vision problems. OpenCV was originally developed in 1999 by Intel but later supported by Willow Garage. OpenCV supports a variety of programming languages such as C++, Python, Java, etc. Support for multiple platforms including Windows, Linux, and macOS. OpenCV Python is a wrapper class for the original C++ library to be used with Python. Using this, all of the OpenCV array structures get converted to/from NumPy arrays. This makes it easier to integrate it with other libraries that use NumPy. For example, libraries such as SciPy and Matplotlib

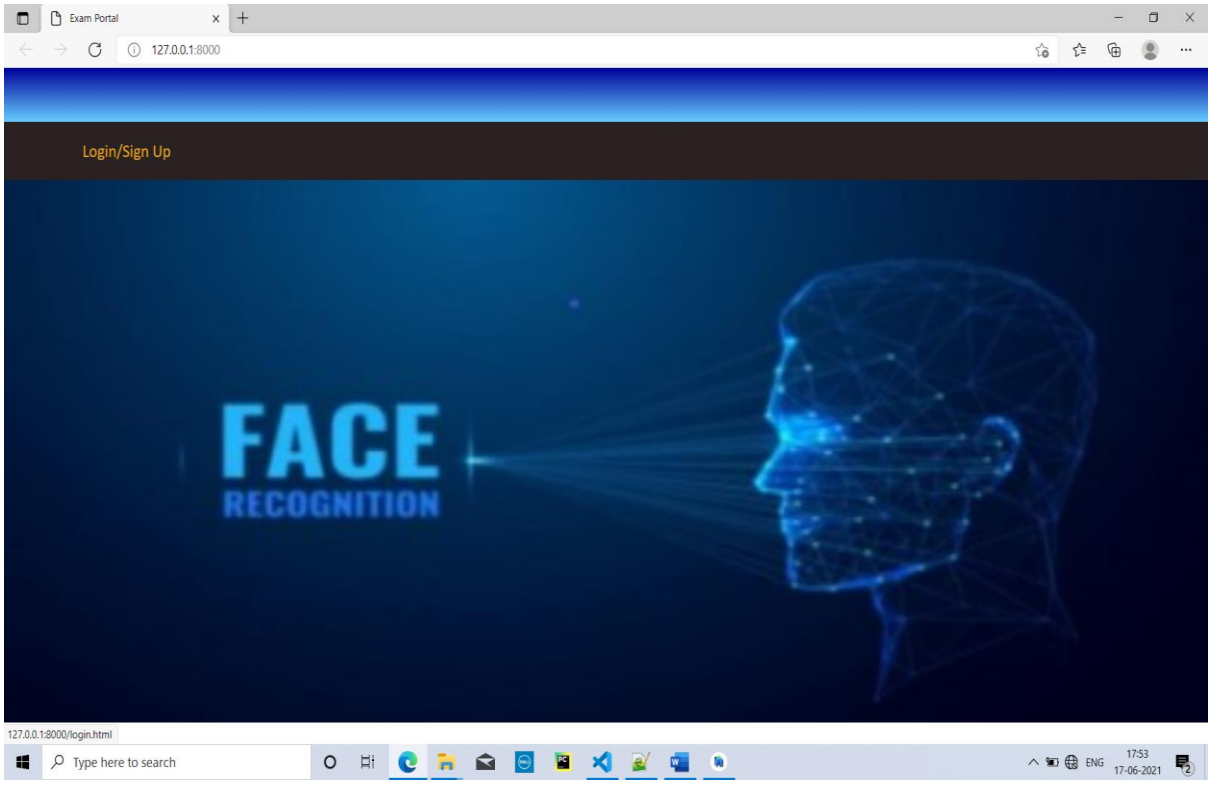
- Face-Recognition

Recognize and manipulate faces from Python or from the command line with the world's simplest face recognition library. Built using dlib's state-of-the-art face recognition built with deep learning. The model has an accuracy of 99.38% on the Labeled Faces in the Wild benchmark. This also provides a simple face_recognition command line tool that lets you do face recognition on a folder of images from the command line!

9.1.1 Screenshots of the System

- Main Page

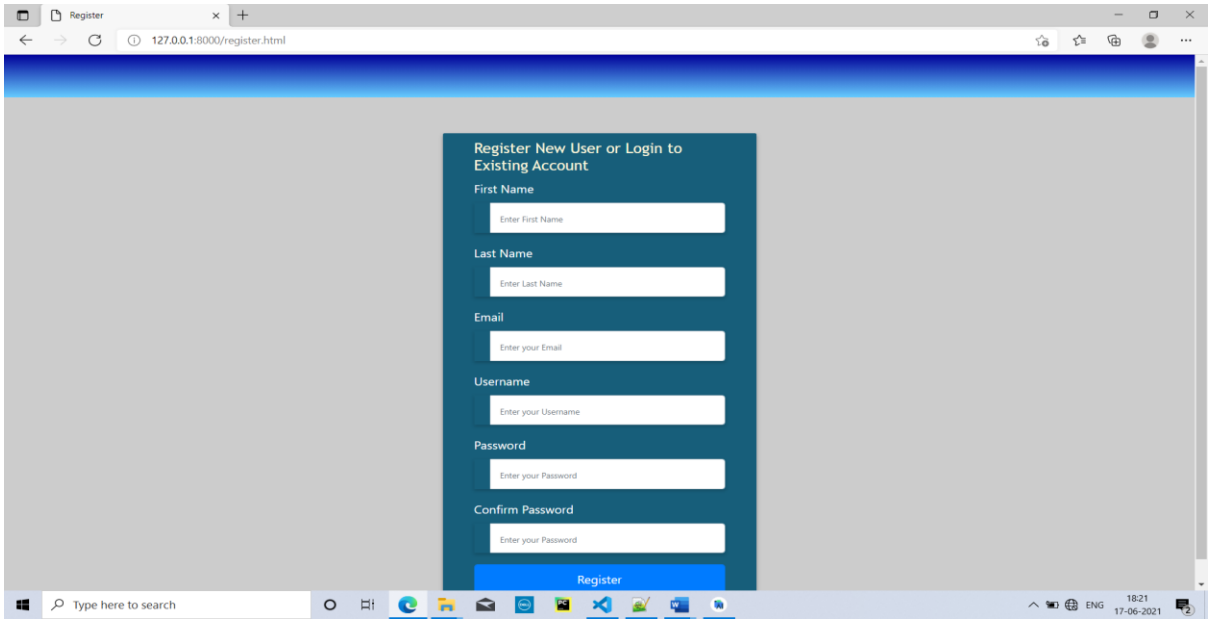
The main page shows Login/SignUp of the system, login and registration.



Screenshot 1: Main Page

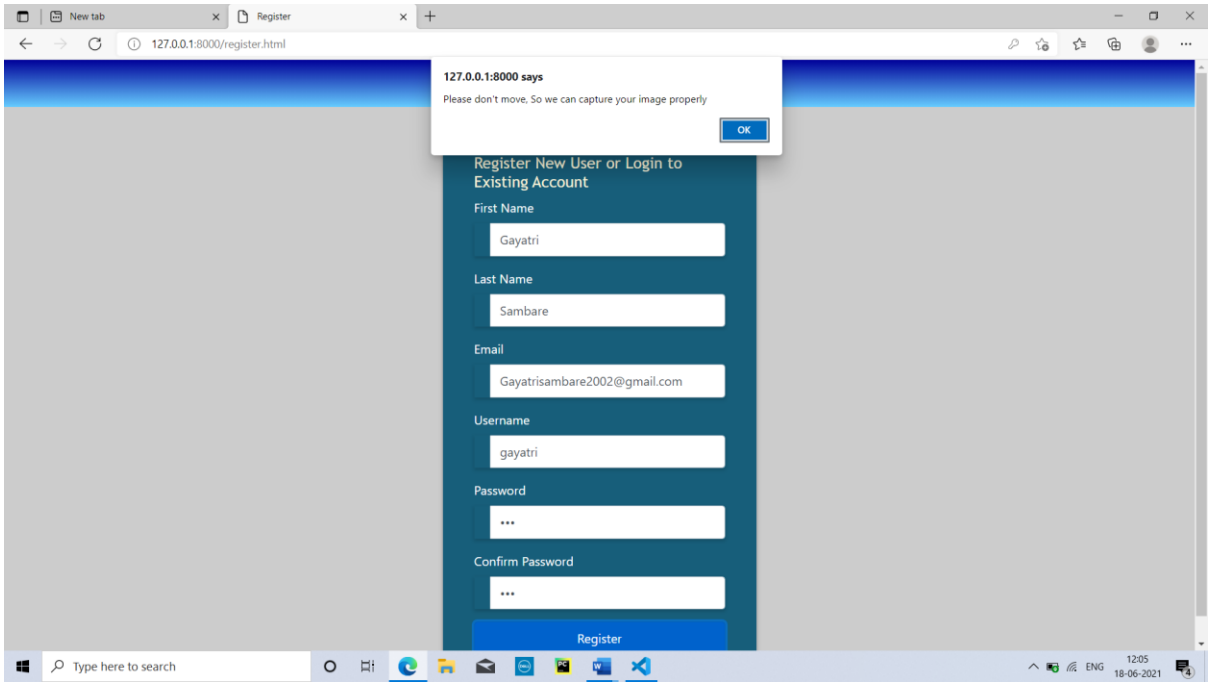
- Registration Page

The main page shows Registration of the system where user can create an account.



Screenshot 3: Registration Page

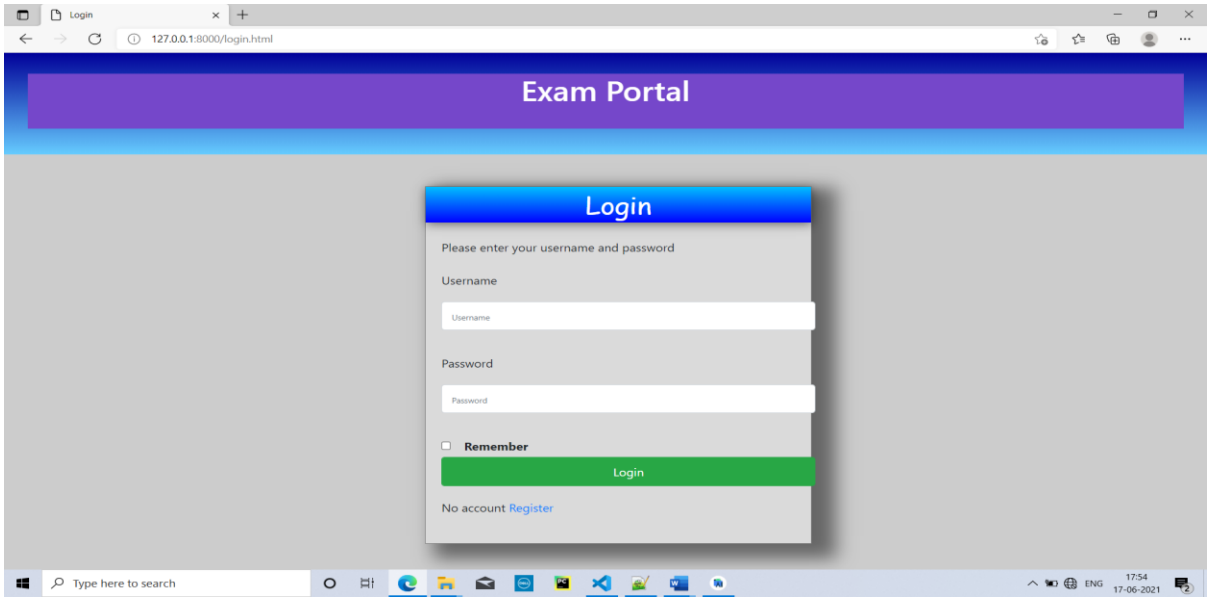
After fill the registration form the alert message is appear "Please don't move, so we can capture your image properly".



Screenshot 4: Prompt message to User for Capturing Image

- Login Page

The main page shows Login page of the system where user can enter username and password if he/she has already an account.



Screenshot 4: Login Page

After fill the login form the alert message is appear “Please don’t move, so we can recognize your face”.

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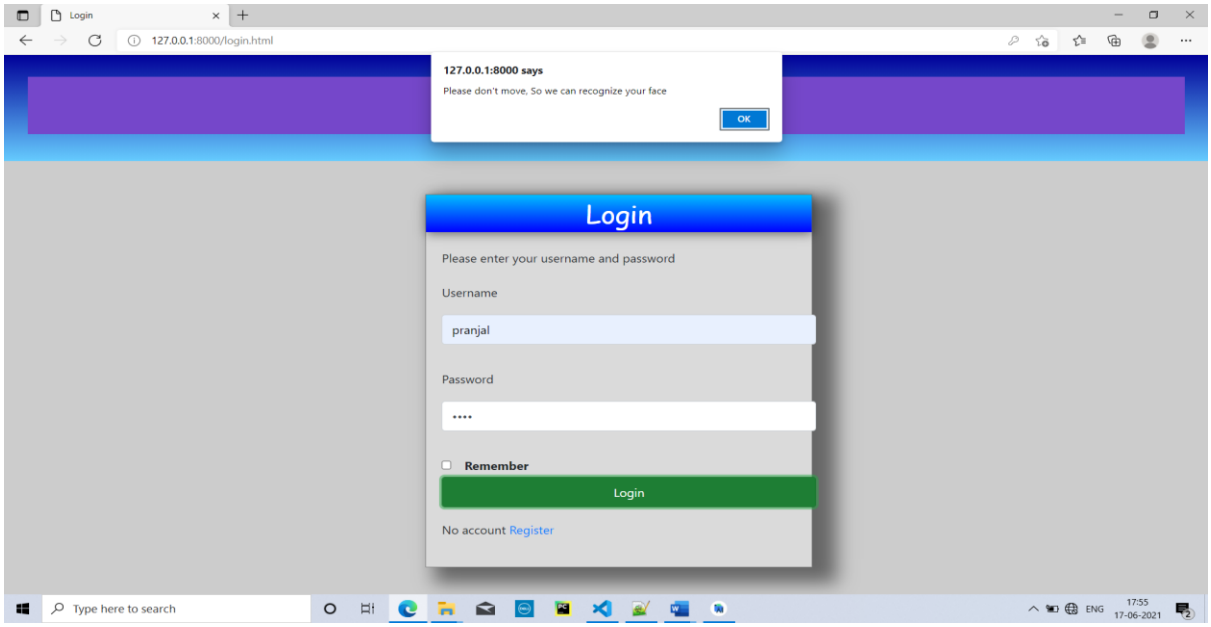
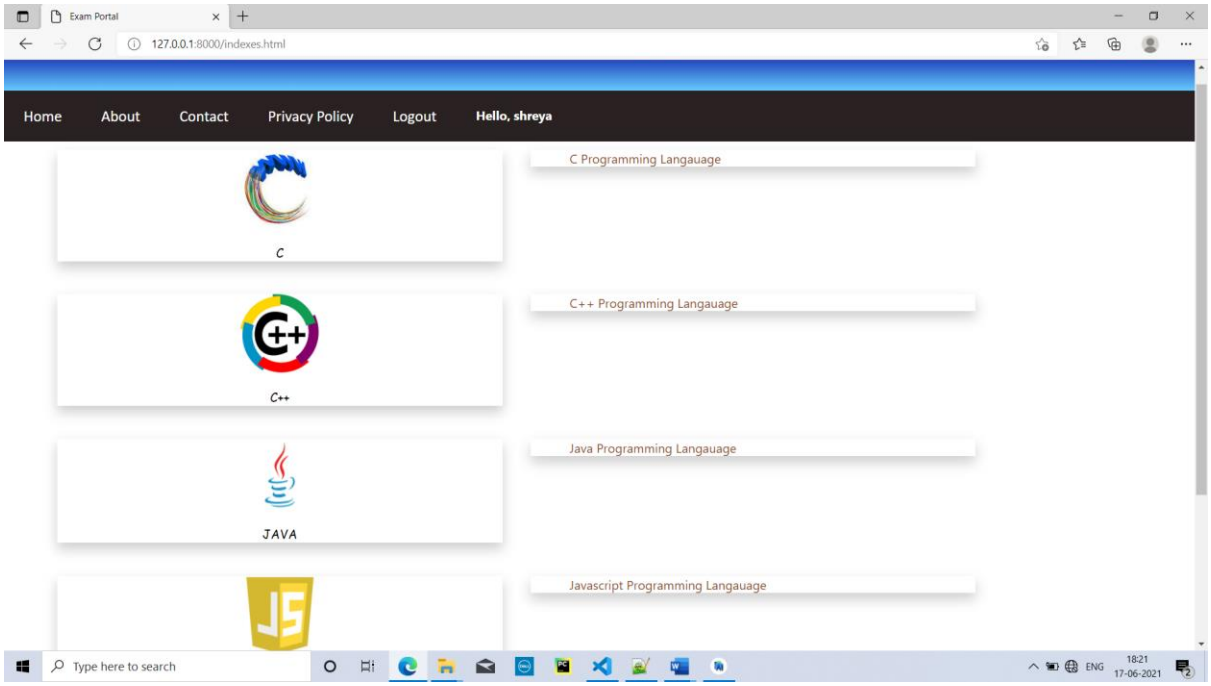


Screenshot 5: Face Recognition Request Prompt

- Home Page

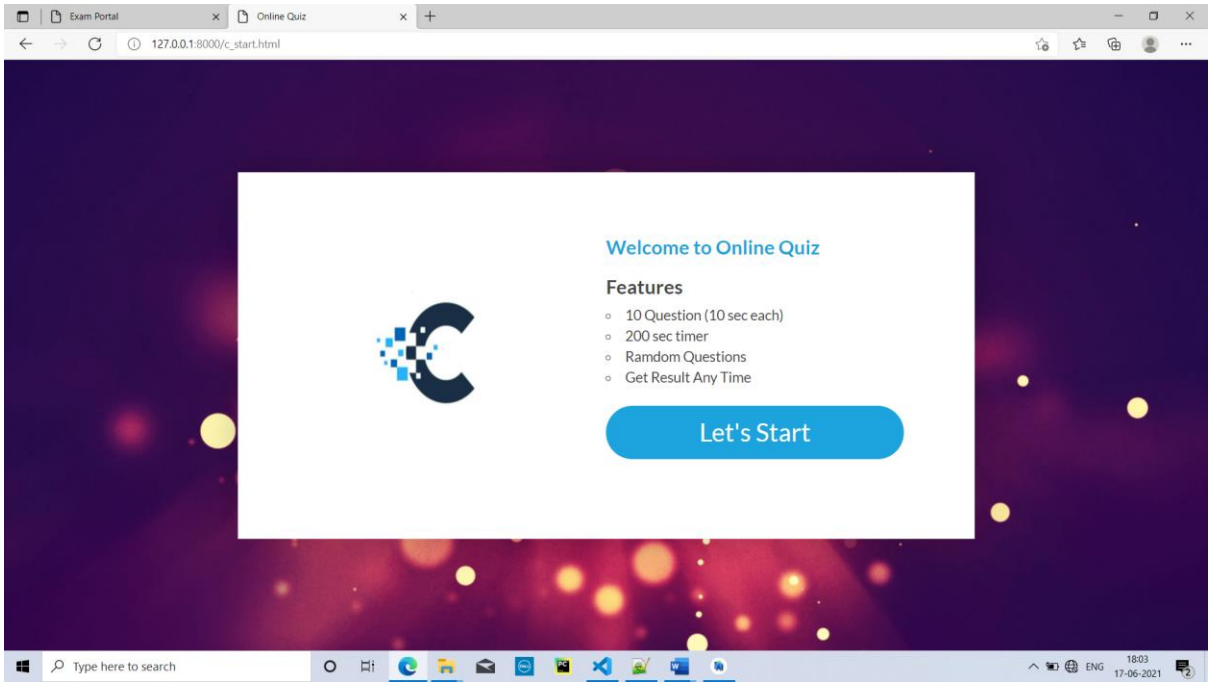
The main page will display to user to only if he/she login successfully after authenticating face.



Screenshot 6: Home Page

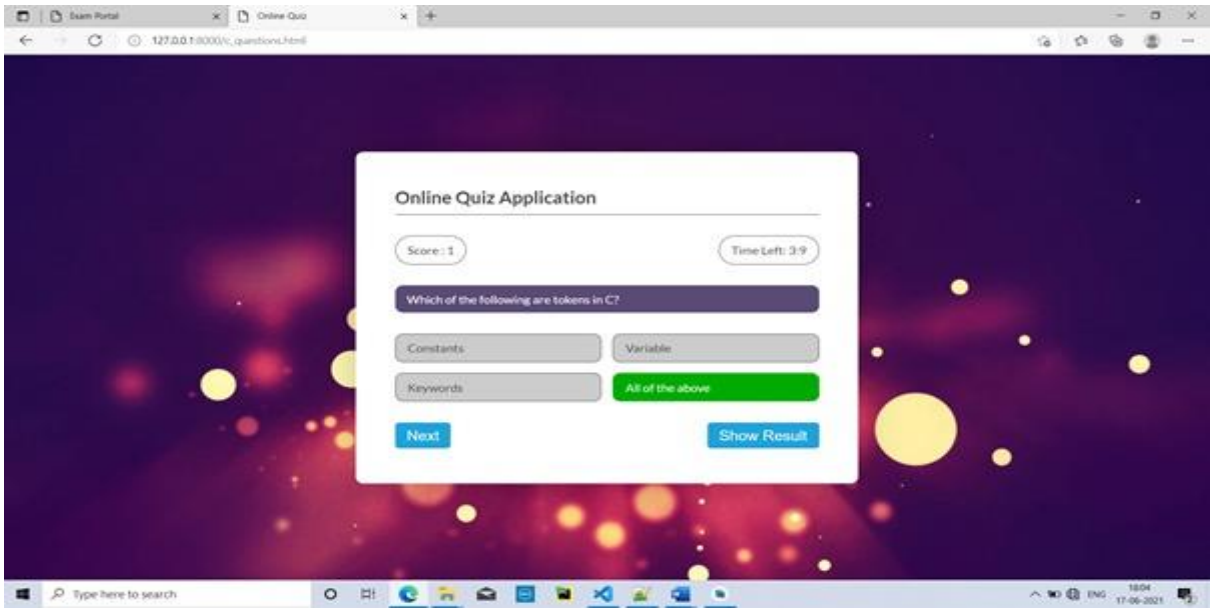
- C Programming Quiz Page

If user clicks on C programming block then he/she will redirect to this page. Similarly according to user's choice respecting Quiz will open.



Screenshot 7: C Programming Quiz Page

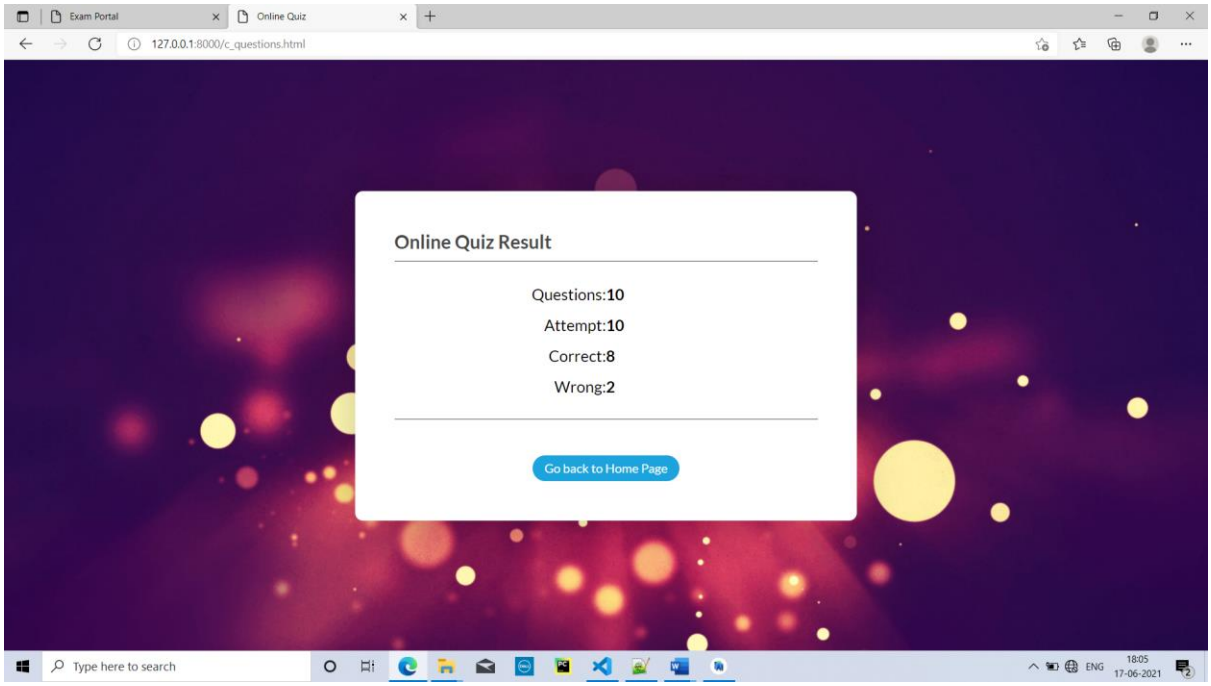
If user clicks on Start then he/she has to solve questions which will display one by one. Similarly according to user's choice respecting Quiz will open.



Screenshot 8: Questions Page

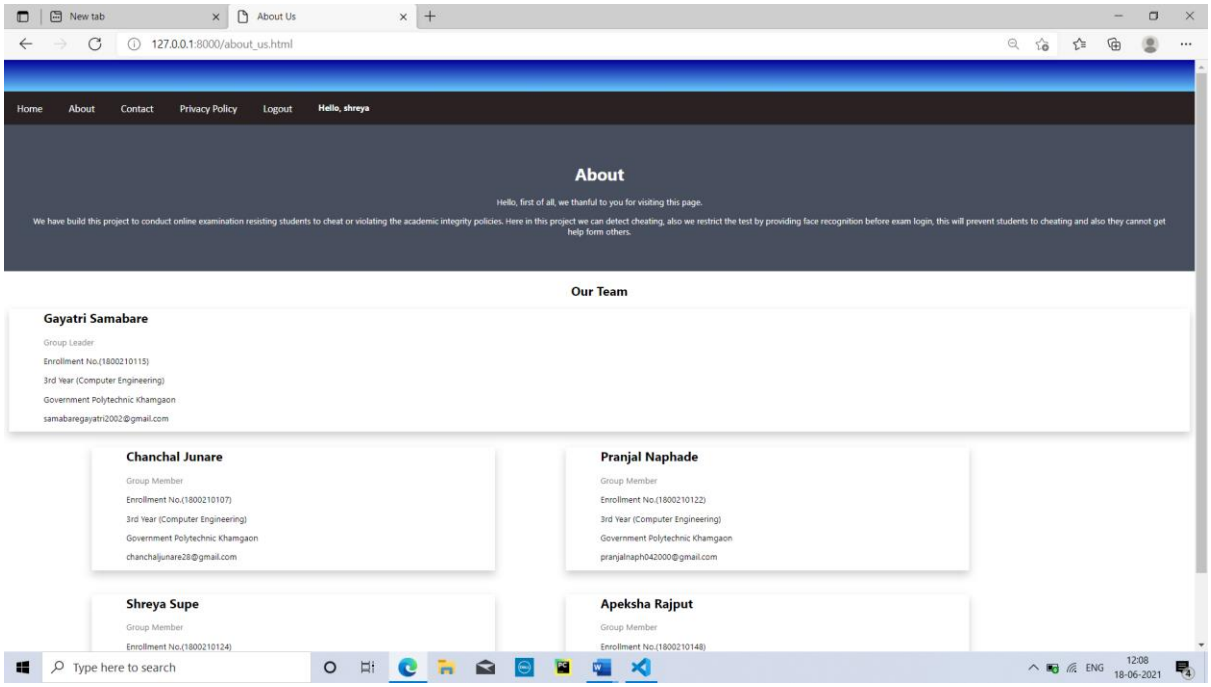
- Displaying Score Page

This page will display score of the quiz, user had taken. Every time when user give quiz for all subjects respecting score will display on this page at that instance.



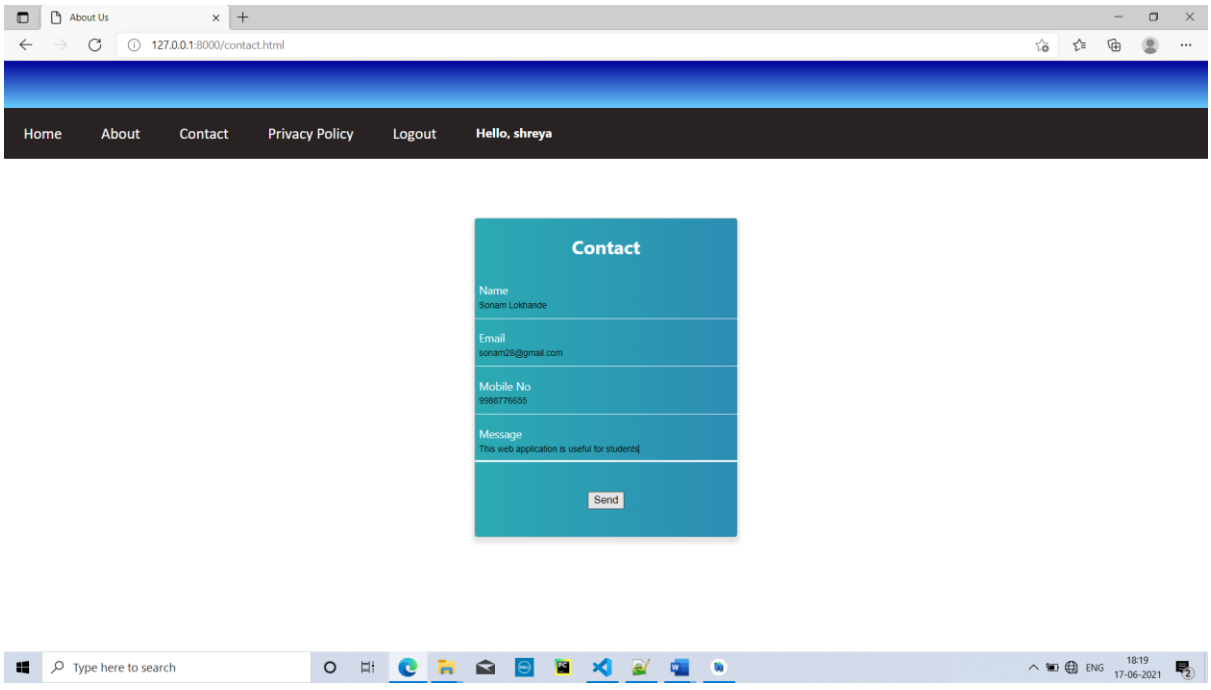
Screenshot 9: Quiz Score Page

- About Page



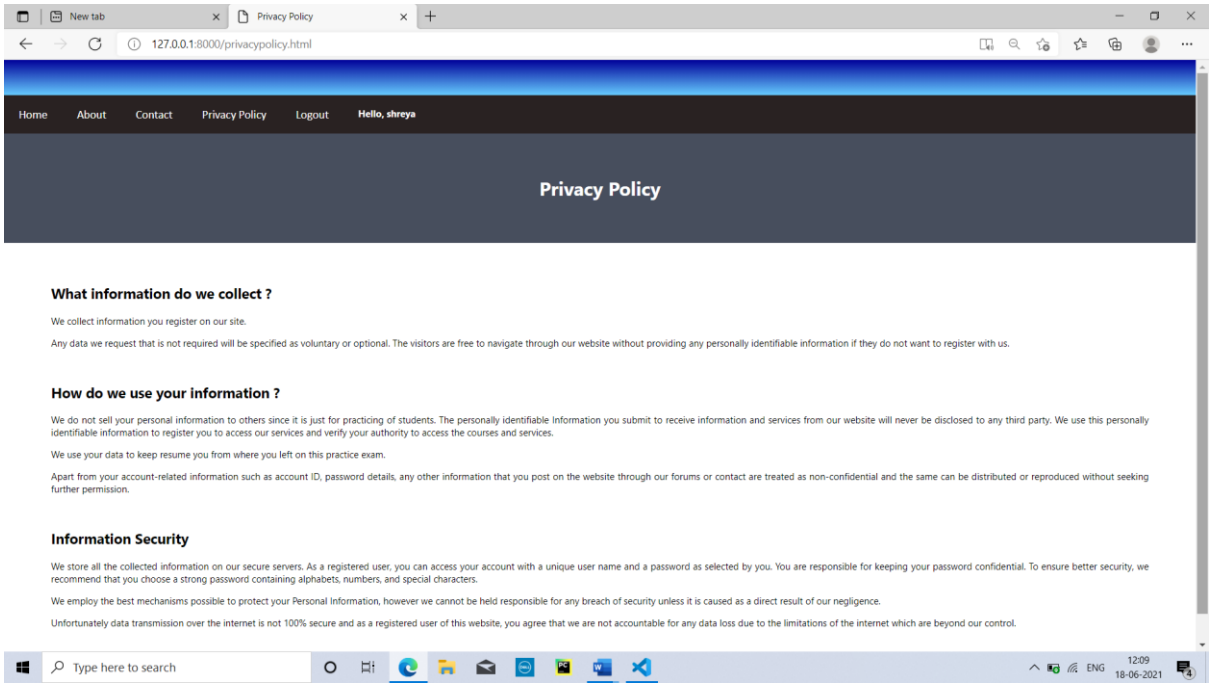
Screenshot 10: About Page

- Contact Page



Screenshot 11: Contact Page

- Privacy Policy Page



Screenshot 12: Privacy Policy Page

9.2 Testing of the System

9.2.1 White Box Testing

For the white box testing, we tested each portion of the code to ensure that they function as intended. We designed a series of varied test cases to use on the system to verify that all of the constraints are met in any situation. The test cases asserted the system's ability to maintain its functions in standard use situations, as well as potential edge cases.

- **Login and Registration**

We tested regular login and registration function. We first tested to register with a conflict username, and the system showed a warning. We then login with username and incorrect password, and the system also provided a warning.

- **Facial Detection and Recognition**

We tested our facial detection and recognition part using different faces. The system was able to detect all faces appeared on the screen and successfully authenticated the correct user.

- **Gesture Recognition**

We tested gesture recognition by performing requested gestures assigned by the system. The system successfully recognized the gestures.

- **Image Impersonation**

The last test we did is to test image impersonation. Face recognition test can be passed by using photos if the camera is not good enough to detect image depth. Our design solves this problem because it requires the person to perform gestures. We tested that although a different person holding the picture can pass the face recognition part, the gesture testing cannot be passed.

9.2.2 Black Box Black Testing

Black box testing enlists the help of individuals not involved with the development of our application, which include classmates and friends. They understand what the system is designed to do, but not how it is done. The testers then used the system to sign up and login, as if they are real users of the system.

CHAPTER 10

10. Conclusion and Future Scope

10.1 Conclusion

The Face Recognition for Exam Login project that has been carried out, it can be concluded that the existence of this application exam is carried out with an online system that aims to gain flexibility of time and space in its implementation and clarification of face recognition methods that aim to avoid defects. In the future, further application development is expected by using updated algorithms for face recognition with a higher degree of accuracy. Trials for this method are only carried out with the same level of lighting, not yet done at different lighting levels and distances. Since the face recognition algorithm we use is more than 99% accurate, the site only needs to compare the user's face to one stored image, rather than against a million different faces like Facebook, and our implementation checks the user's identity over several frames, we believe that face recognition is a secure, reliable, and simple method of authentication.

10.1 Future Scope

We also need to discuss approach of camera planning based on the result of position estimation in order to improve face detection effectiveness by using interaction between our web application and the user. On other hand our system can be improved by integrating video streaming service and storing and keep track of user's activity through every login sessions to provide more profound applications in the field of distance education.

Following are some of the future plans we can do in order to improve more this application:

- **Recognize more gestures**

We plan to add more gestures into our system such as waving hands and opening mouth. The increasing number of random gestures will make the user harder to predict the move, and thus improve the security of the system.

- **Store and encrypt face data in a separate database**

The photos of the users in the database have a potential security issue. To solve that, we plan to store and encrypt the photos of the user in a separate database so that even if the database is being hacked, the photos will not leak.

- **Replace user's photo with face encoding**

To bring the security of our system to the next level, we could only store the characteristics of the user's face in the database instead of the photo. Even if the face encoding data is leaked, the hacker cannot recover user's face.

- **Remove the need for password in our implementation**

When our system reaches really high accuracy, we could remove process of entering the password during login. User's account can be verified with facial recognition as the single security check.

CHAPTER 11

11. References and Bibliography

11.1 References

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