Criminal and Culprit Visage

Submitted in partial fulfillment of the requirements
for the degree of

B.E. Computer Engineering

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CERTIFICATE

This is to certify that the project entitled **"Criminal and Culprit Visage"** is a bonafide work of **"Samson Joelkumar Nadar(Roll no.32), Saurabh Anilkumar Mishra(Roll no.31), Alvin Alex(Roll no.26) and Joshua Ashok Torlikonda(Roll no.22)"** submitted to the University of Mumbai in partial fulfillment of the requirement for the award of the degree of B.E. in Computer Engineering.

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Project Approval Report for B.E.

This project report entitled ***"Criminal and Culprit Visage"*** by ***Samson Joelkumar Nadar(Roll no.32), Saurabh Anilkumar Mishra(Roll no.31), Alvin Alex(Roll no.26) and Joshua Ashok Torlikonda(Roll no.22)*** is approved for the degree of ***B.E. in Computer Engineering***.

Examiners

1. ———————————

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Date:

Place: Mumbai

Declaration

We declare that this written submission represents our ideas in our own words and where others' ideas or words have been included, we have adequately cited and referenced the original sources. We also declare that we have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any idea/data/fact/source in our submission. We understand that any violation of the above will be cause for disciplinary action by the Institute and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been taken when needed.

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Abstract

In this modern age, the overall crime rate is increasing day-by-day and to cope up with this the law enforcement departments too should find ways that would speed up the overall process and help them in bringing one to justice. One such way can be using face recognition technology for identifying and verifying the criminal. The traditional approach here is to use the hand-drawn face sketches drawn by forensic sketch artists to identify the criminal, modernizing this would mean using the hand-drawn sketch and then matching them with the law enforcement department's database to identify the criminal. Using this approach would result in the various limitations with latest technologies and even would be time consuming as there are very few forensic sketch artists available when compared to the increasing crime ratio. Our project is aimed at decreasing the time span and speeding up this process by providing a standalone platform to the law enforcement department which would allow users to create an accurate face sketch of the suspect without the help of a forensic sketch artist and no special training or artistic skills. The sketch can be created using a drag and drop feature in the application with a variety of face elements and can automatically match the drawn composite face sketch with the law enforcement department's database much faster and efficiently using deep learning and cloud infrastructure.

Keywords: *(Forensic Face Sketch, Face Sketch Construction, Face Recognition, Criminal Identification, Deep Learning, Machine Locking, Two Step Verification.)*

Contents

1 Introduction **1**

1.1 Description 1

1.2 Problem Formulation 2

1.3 Motivation 2

1.4 Proposed Solution 3

1.5 Scope of the project 3

2 Review of Literature **5**

3 System Analysis **8**

3.1 Functional Requirements 8

3.2 Non-Functional Requirements 9

3.3 Specific Requirements 11

3.4 Use-Case Diagrams and Description 12

4 Analysis Modeling **14**

4.1 Activity Diagram 14

4.1.1 Application flow diagram 14

4.1.2 Face Construction diagram 15

4.1.3 Face Recognition diagram 16

4.2 Functional Modeling 17

4.2.1 Data Flow Level 0 17

4.2.2 Data Flow Level 1 18

4.2.3 Data Flow Level 2 19

5 Design **20**
5.1 Architectural Design 20

6 Implementation **23**
6.1 Algorithms/Methods Used 23
6.1.1 Machine Locking: 23
6.1.2 Evaluation and Testing 23
6.1.3 CNN (Convolutional Neural Network) 23
6.1.4 GNN (Generative Adversarial Networks) 24
6.1.5 Principal Component Analysis 24
6.1.6 Deep Learning for Face Recognition: 24
6.1.7 Recognition and Matching 25
6.1.8 Code Snippet for Sketch Uploading 25
6.1.9 Code Snippet for Sketch Opening 26
6.2 Working of the project 27

7 Results and Discussions **32**
7.1 Results and Evaluation 32

8 Conclusions **35**
8.1 Conclusion 35
8.2 Future Scope 35

References **37**

Acknowledgements **39**

List of Figures

3.1 Face Feature – Head 10
3.2 Face Feature – Eyes 10
3.3 Face Feature – Ears 10
3.4 Use-Case representation of Face Construction and Face Recognition 12

4.1 System flow diagram 14
4.2 Construction of Face 15
4.3 Recognition of face 16
4.4 DFD Level 0 17
4.5 DFD Level 1 18
4.6 DFD Level 2 19

5.1 Architecture of the System 20

6.1 Sketch uploaded successfully 25
6.2 Sketch opened from file 26
6.3 Login page 27
6.4 Create and upload page 27
6.5 Sketch page 28
6.6 Face sketch 28
6.7 hair sketch 29
6.8 eye sketch 29
6.9 fetching from system 30
6.10 fetching page 30

6.11 fetched image from system 31
6.12 Not found data 31

7.1 Matched face 32
7.2 Not matched face 33
7.3 builded successfully 33
7.4 Completion of program 34

Chapter 1

Introduction

1.1 Description

In an era where facial recognition technology plays an increasingly critical role in law enforcement and security, our project aims to develop a cutting-edge Facial Construction and Criminal Identification System. This innovative application empowers users to construct custom faces by intuitively dragging and dropping various facial features, such as eyes, noses, and mouths. Beyond the creative aspect, this tool will serve a crucial purpose: checking the constructed faces against a comprehensive facial recognition database to identify potential matches with known criminals or individuals of interest. The system's primary objective is to enhance the efficiency of law enforcement agencies and security personnel by providing them with a user-friendly yet powerful tool for generating facial composites quickly. Users will be able to fine-tune and customize facial features to create accurate representations, helping bridge the gap between eyewitness descriptions and accurate identification. The integration of facial recognition technology ensures that the constructed faces are cross-referenced against a database of known individuals, offering real-time feedback on potential matches. We prioritize data privacy and security, and our system will adhere to the highest ethical and legal standards to protect sensitive facial data. This project represents a significant step forward in the application of artificial intelligence to law enforcement and public safety, potentially aiding in the swift identification and apprehension of suspects.

1.2 Problem Formulation

In this modern age, the overall crime rate is increasing day-by-day and to cope up with this the law enforcement departments too should find ways that would speed up the overall process and help them in bringing one to justice. One such way can be using face recognition technology for identifying and verifying the criminal. The traditional approach here is to use the hand-drawn face sketches drawn by forensic sketch artists to identify the criminal, modernizing this would mean using the hand-drawn sketch and then matching them with the law enforcement department's database to identify the criminal. Using this approach would result in the various limitations with latest technologies and even would be time consuming as there are very few forensic sketch artists available when compared to the increasing crime ratio. Thus, there is a need for creating an application which would not just provide a set of individual features like eyes, ears, mouth, etc. to be selected to create a face sketch that would help in finding the criminal much faster and efficiently.

1.3 Motivation

There is no dedicated Criminal Face Detection System to assist in facial detection of criminals, rather police technicians have to go through different pictures of criminals and manually slice each picture to generate images, this will usually lead to the generation of low resolution and blurred images. This system is aimed to identify the criminals in any investigation department. Scope of the system is the complete identification of the face. Within the allocated time completing the system with the specified user requirements.
A thorough survey has revealed that various methods and combinations 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 the face detection part and neural network approach for the face recognition part. The main reason in this selection is their smooth applicability and reliability issues.The accuracy of text and face recognition is

based upon pose, illumination, emotions, facial components and image quality. Certain features need to be incorporated in the system to process real time images at a faster rate with high precision. Another aspect of the research includes, developing a model which if trained on given criminal record dataset can predict the face sketch of a criminal based upon features fed as input by a witness

1.4 Proposed Solution

Utilizing advanced facial recognition technologies, our system is designed to support forensic investigations in identifying criminals from sketches. The process commences with robust face detection algorithms, ensuring precise localization of facial features within images or video frames. Leveraging intuitive drag-and-drop interfaces, witnesses or investigators can construct detailed sketches, facilitating the creation of facial composites that closely resemble suspects. These sketches undergo information-theoretic encoding, optimizing data representation for efficient recognition. Our approach includes a feature-based method for matching sketches to existing photo databases, enhancing the likelihood of accurate suspect identification. Moreover, we have developed a sophisticated human face image searching system, enabling rapid retrieval of relevant images based on sketch descriptions. Automation plays a pivotal role in streamlining the production of facial composites. By automating various processes, such as feature alignment and blending, we ensure consistency and efficiency in composite generation. This automation extends to identification tasks, where the system assists forensic experts in matching facial composites against databases of known individuals, expediting the investigative process.

1.5 Scope of the project

This project's future potential is bright because there are many opportunities for growth and improvement. First off, further improvements to the deep learning models may result in even greater rates of suspect identification accuracy. The realism of composite sketches could be increased by using generative adversar-

ial networks (GANs) for sketch-to-photo synthesis. Additionally, the system's applicability and inclusivity can be improved by incorporating a larger and more varied library of images and sketches from various geographical locations and demographic groups. Additionally, integrating live video feeds and real-time facial recognition technology could help law enforcement organizations identify suspects in unpredictable circumstances. Forensic artists and law enforcement organizations will need to work together for real-world implementation and testing in order to improve the system's usability and meet specific operational requirements. Additionally, investigating the use of this technology in other fields, such as border security and missing person searches, opens up fascinating prospects for its expanded application. Overall, this initiative lays the groundwork for a new age in forensic science where state-of-the-art technology and human

Chapter 2

Review of Literature

1] In recent years, many deep learning (DL) methods have been proposed by researchers for various tasks, particularly face recognition (FR), which has seen an enormous leap facilitated by these techniques. The hierarchical architecture of DL methods allows deep FR systems to learn discriminative face representation, leading to a significant improvement in state-of-the-art performance on FR systems and the encouragement of diverse and efficient real-world applications. In this paper, a comprehensive analysis of various FR systems leveraging different types of DL techniques is presented, summarizing 168 recent contributions from this area. The papers related to different algorithms, architectures, loss functions, activation functions, datasets, challenges, improvement ideas, current, and future trends of DL-based FR systems are discussed. A detailed discussion of various DL methods is provided to understand the current state-of-the-art, followed by the discussion of various activation and loss functions for the methods. Additionally, different datasets used widely for FR tasks are summarized, and challenges related to illumination, expression, pose variations, and occlusion are discussed. Improvement ideas, current, and future trends of FR tasks are then discussed.

2] Face recognition technology is a biometric technology that is based on the identification of facial features of a person. The face images are collected by people, and the images are automatically processed by the recognition equipment. The related researches of face recognition are introduced from different

perspectives in the paper. The development stages and the related technologies of face recognition are described. The research of face recognition for real conditions is introduced, and the general evaluation standards and the general databases of face recognition are introduced. A forward-looking view of face recognition is given. Face recognition has become the future development direction and has many potential application prospects.

3] Distinguishing features in the human ear can be utilized for identification purposes. Automated ear detection from 3D profile face images is deemed crucial in ear-based human recognition. In this work, a complete pipeline is proposed, including synthetic data generation and ground-truth data labeling for ear detection in 3D point clouds. The ear detection problem is formulated as a semantic part segmentation problem, wherein the ear is directly detected in 3D point clouds of profile face data. EarNet, a modified version of the PointNet++ architecture, is introduced, and rotation augmentation is applied to handle different pose variations in real data. It is demonstrated that PointNet and PointNet++ cannot manage the rotation of a given object without such augmentation. Synthetic 3D profile face data is generated using statistical shape models. Additionally, an automatic tool has been developed and made publicly available to create ground-truth labels of any 3D public dataset that includes co-registered 2D images. The experimental results on real data demonstrate higher localization compared to existing state-of-the-art approaches.

4] Face photo–sketch synthesis aims to generate a facial sketch/photo conditioned on a given photo/sketch. It covers wide applications including digital entertainment and law enforcement. Precisely depicting face photos/sketches remains challenging due to the restrictions on structural realism and textural consistency. While compelling results are achieved by existing methods, they mostly yield blurred effects and significant deformation over various facial components, leading to the unrealistic feeling of synthesized images. To tackle this challenge, in this article, the use of facial composition information to aid the

synthesis of face sketch/photo is proposed. Especially, a novel composition-aided generative adversarial network (CA-GAN) for face photo–sketch synthesis is proposed. In CA-GAN, paired inputs are utilized, including a face photo/sketch and the corresponding pixelwise face labels for generating a sketch/photo. Next, to focus training on hard-generated components and delicate facial structures, a compositional reconstruction loss is proposed. In addition, a perceptual loss function is employed to encourage the synthesized image and real image to be perceptually similar. Finally, stacked CA-GANs (SCA-GANs) are used to further rectify defects and add compelling details. The experimental results show that our method is capable of generating both visually comfortable and identity-preserving face sketches/photos over a wide range of challenging data. In addition, a significant decrease in the best previous Fréchet inception distance (FID) from 36.2 to 26.2 for sketch synthesis, and from 60.9 to 30.5 for photo synthesis is achieved by our method.

Chapter 3

System Analysis

3.1 Functional Requirements

- **Security and Privacy:** The major concern of the law enforcement department before adapting any system is security and privacy. Keeping this in mind the application is designed to protect the privacy and carry out the security measures in the following ways.
- **Machine Locking:** The Machine locking technique would ensure that the application once installed on a system could not be tampered and could not be operated on any other system, for which the application uses two locking parameters i.e. one software and one hardware locking parameter. HD ID – Volume serial of hard-drive with OS. NET ID – Hardware ID – MAC Address.
- **Two Step Verification:** Every law enforcement authorized user would be given an official E-Mail ID which would be used to login on to the application, thus using this step would require the user to enter a random code being shared with them on their mobile/desktop in order to complete the logging process.
- **Centralized Usage:** The system which has the application been installed would be connected to a centralized server of the law enforcement department campus containing the database and the other important feature set of the application, thus the application could not be operated once discon-

nected from the server.

- **Backward Compatibility:** The major drawback in adapting any new system is the complication involved in completing migrating from the previous technique to the new technique, Hence resulting in the wastage of time resources. To overcome this issue, we have designed our application in such a way that even the hand-drawn sketches can be uploaded and the user can use the deep learning algorithms and cloud infrastructure to identify and recognize the criminal using the hand-drawn sketch.

3.2 Non-Functional Requirements

- Face Sketch Construction using Drag and Drop : In this application, an accurate composite face sketch can be constructed using the predefined facial feature sets provided as tools allowing it to be resized and repositioned as per requirement/described by the eye-witness. Here, the human face can be categorized into various facial features such as head, eyes, eyebrow, lips, nose, ears, etc. and some important wearable components such as hats, specs, etc. too are available in the application for use. Every facial feature when selected would open a wide range of options to choose from based on the requirement/description of the eye-witness. The machine learning algorithm would learn and in future try to suggest all the facial features which could suit the single selected feature and would try to help in completing the composite face sketch much sooner and much more efficiently.

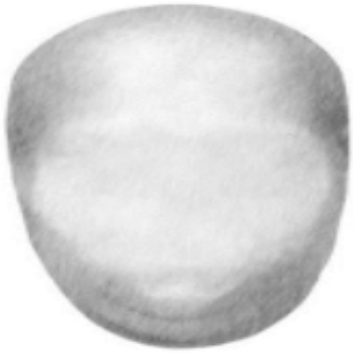


Figure 3.1: Face Feature – Head

Figure 3.2: Face Feature – Eyes

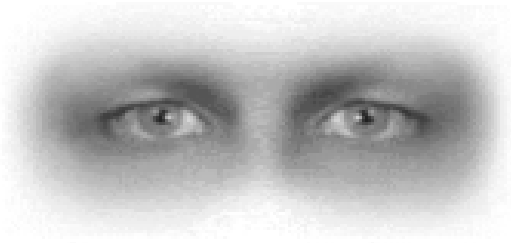


Figure 3.3: Face Feature – Ears

Such are the facial features which can be used in the application to create the composite face sketch of the suspect based on the description provided by the eye-witness to the law enforcement and forensic department.

3.3 Specific Requirements

Hardware Specifications: This application has been designed to run on the minimum possible configuration of hardware.

- Client/ Node Machine:
  - Processor: Intel Dual Core CPU and above
  - RAM: 1 GB and above
  - Hard Disk: 250GB and above
- Server Machine:
  - Processor: Intel Core i3 CPU and above
  - RAM: 4 GB and above
  - Hard Disk: 1 TB and above

Software Specifications: This application is designed to run as a desktop application with part of the data saved on the server for security purpose.

- Client/ Node Machine:
  - Operating System: Windows 7 and above
  - Framework: Java JDK
  - Cloud: Amazon Web Services CLI
- Server Machine:
  - Operating System: Windows Desktop OS or Windows Server Edition
  - Framework: Java JDK
  - Cloud: Amazon Web Services CLI
  - Database: SQLite

3.4 Use-Case Diagrams and Description

Figure 3.4 is a visual representation of the interactions between different actors and the system under consideration. In this case, it is the Algorithm working in different parts.

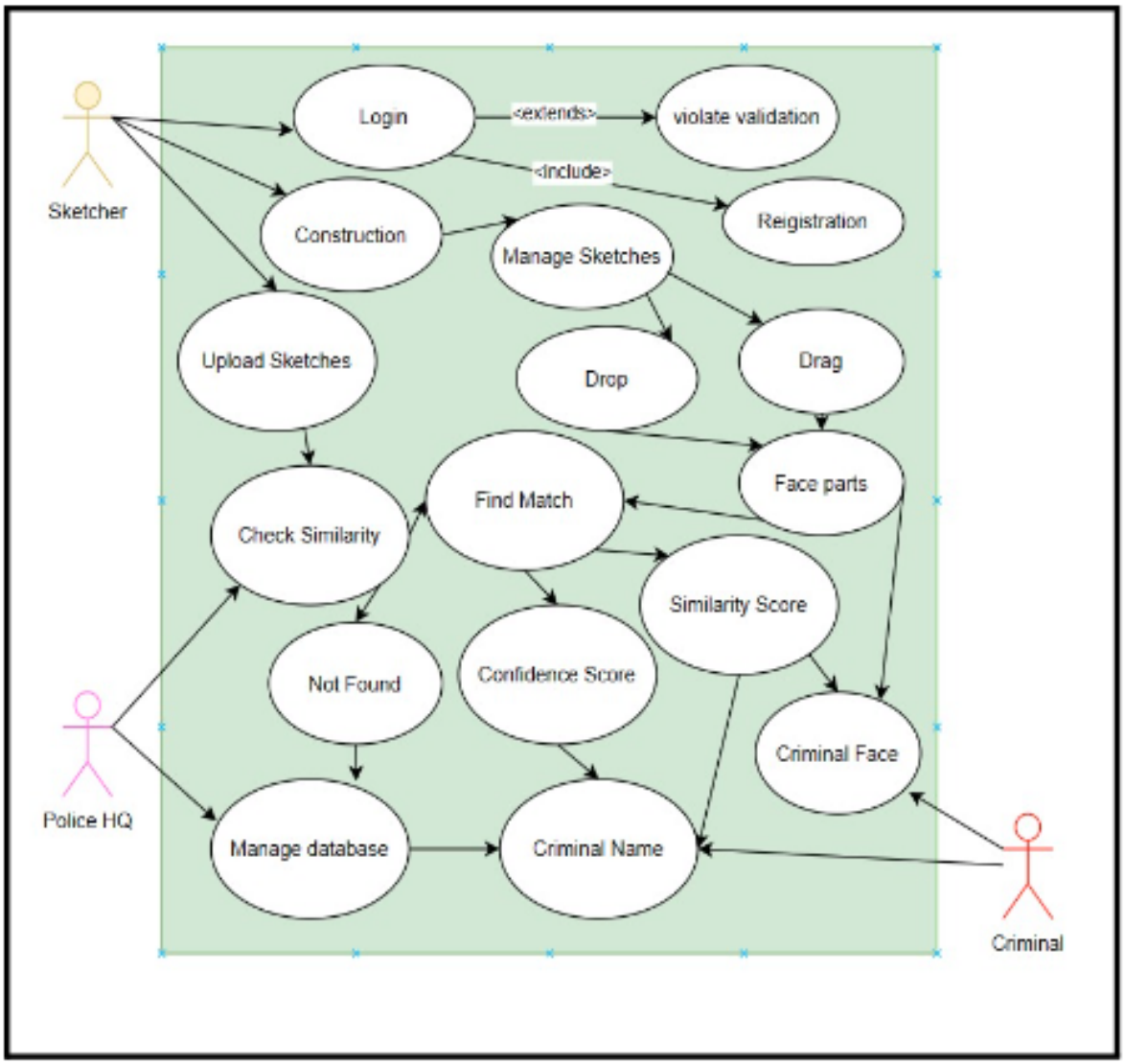


Figure 3.4: Use-Case representation of Face Construction and Face Recognition

Here's a description of the main actors and use cases involved:

Actors:

- **Admin:** A sketcher which acts as a user for the system to create a sketch of a criminal.

- **Police HQ:** Police headquarters which manages the database of the system where all identity of criminals lie.
- **Criminal:** A user that wants to sell of his/her land by uploading it to the Seller's dashboard.

Use Cases:

- **Login:** Login page form where users can be identified and allowed to create a sketch.
- **Construction:** Users can create a face using drag and drop method from the system.
- **Upload sketch:** Users can upload a sketch after creating it or directly from the file.
- **Check similarity:** After uploading the sketch on the cloud system will check the similarity between the sketch and face in the database.
- **Find match:** After checking the similarity from the database it will acknowledge the user that match is found.
- **Criminal face:** After matching from the database it will show the face of the criminal.

Chapter 4
Analysis Modeling

4.1 Activity Diagram

4.1.1 Application flow diagram

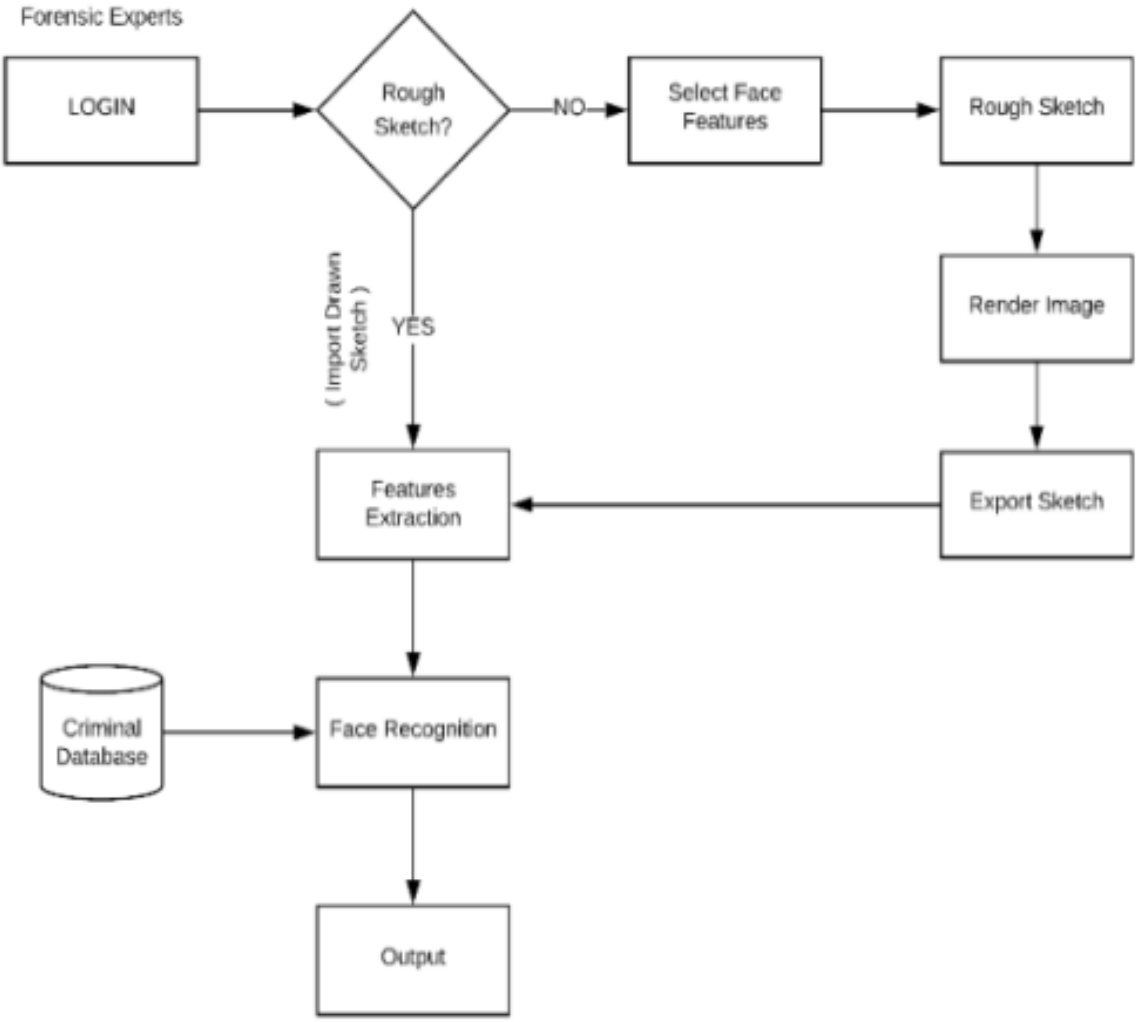


Figure 4.1: System flow diagram

Fig 4.1 represents the overall flow of the system starting with the login page to the actual results being displayed after the sketch is matched by the records in

the database.

4.1.2 Face Construction diagram

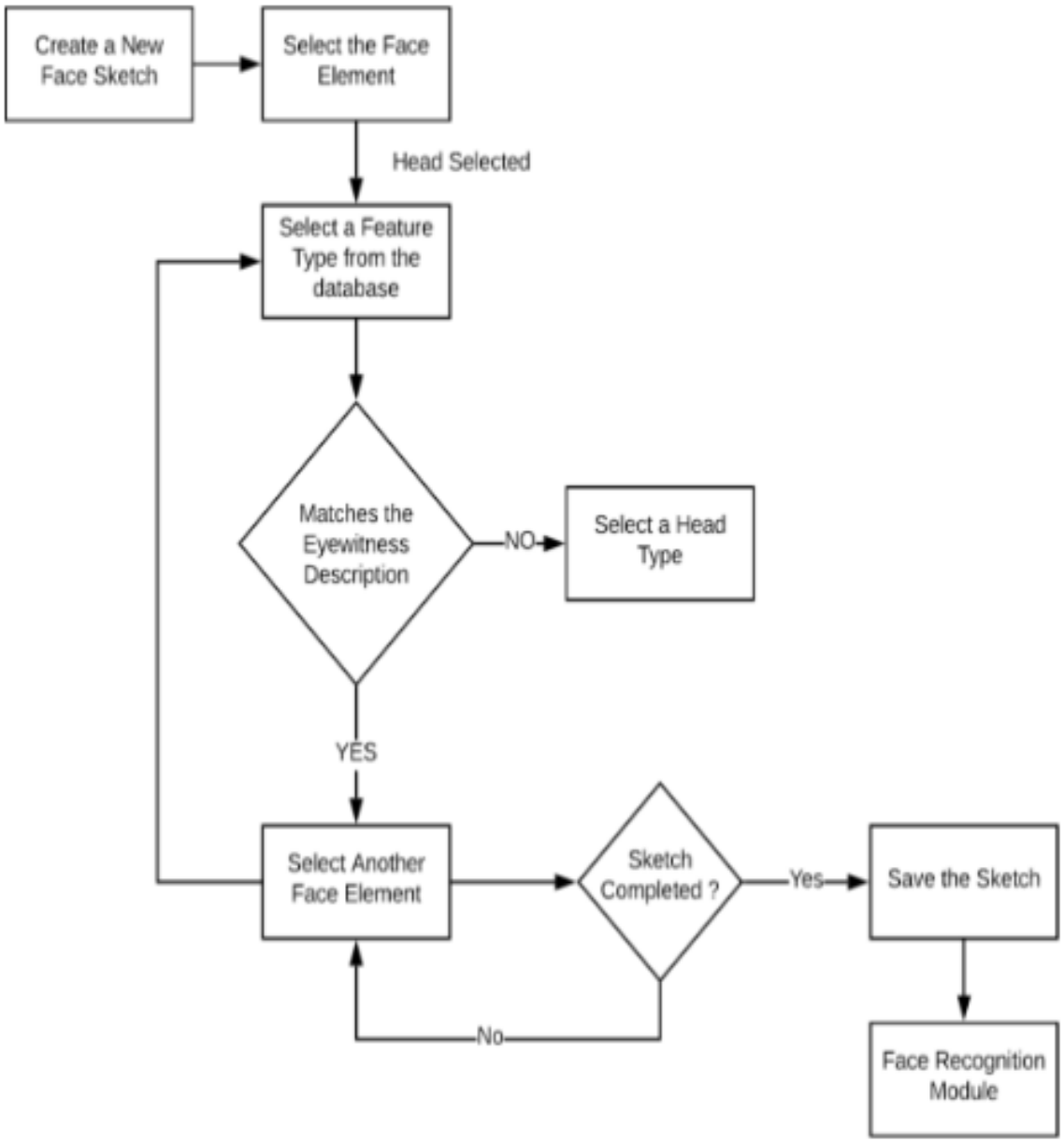


Figure 4.2: Construction of Face

Fig 4.2 illustrates the users flow been followed by the platform to provide an construct accurate face sketch based on the description, the dashboard is designed simple in order to encourage no professional training to go through before using this platform already saving the timeframe which would have been taken a lot time and resources of the Department.

4.1.3 Face Recognition diagram

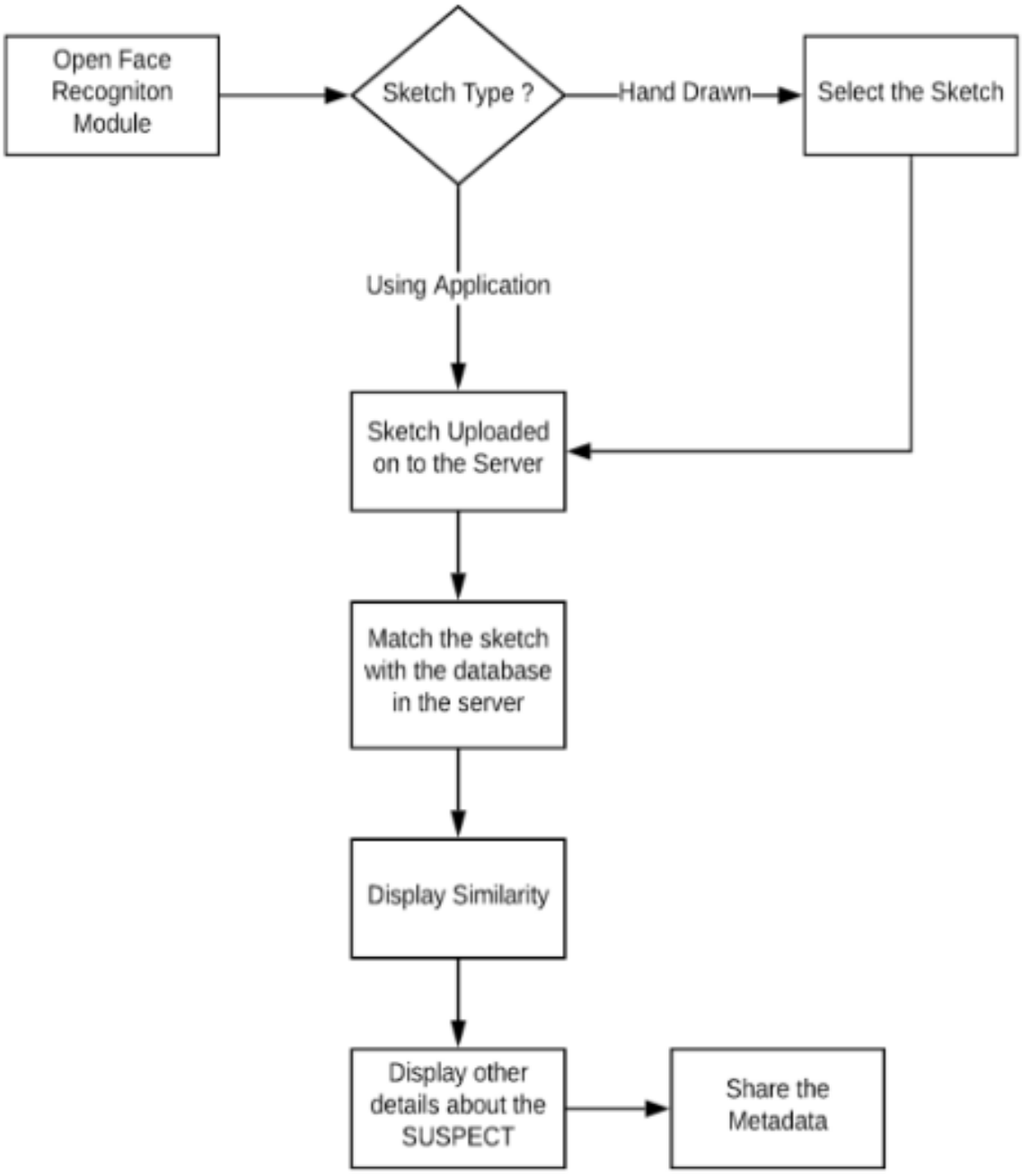


Figure 4.3: Recognition of face

Fig 4.3 illustrates the users flow followed by the platform to provide an accurate face sketch based on the description, the dashboard is designed simple in order to encourage no professional training to go through before using this platform already saving the timeframe which would have taken a lot time and resources of the Department.

4.2 Functional Modeling

4.2.1 Data Flow Level 0

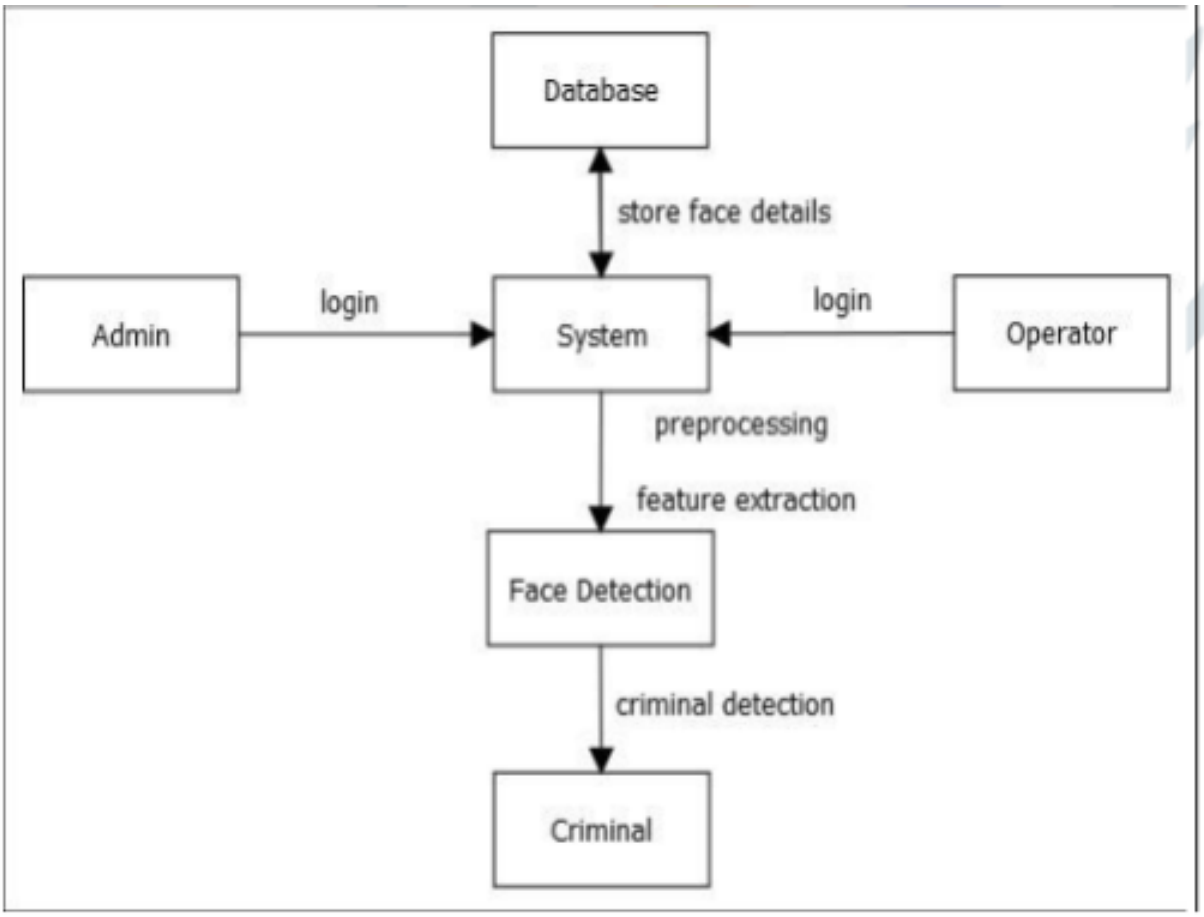


Figure 4.4: DFD Level 0

4.2.2 Data Flow Level 1

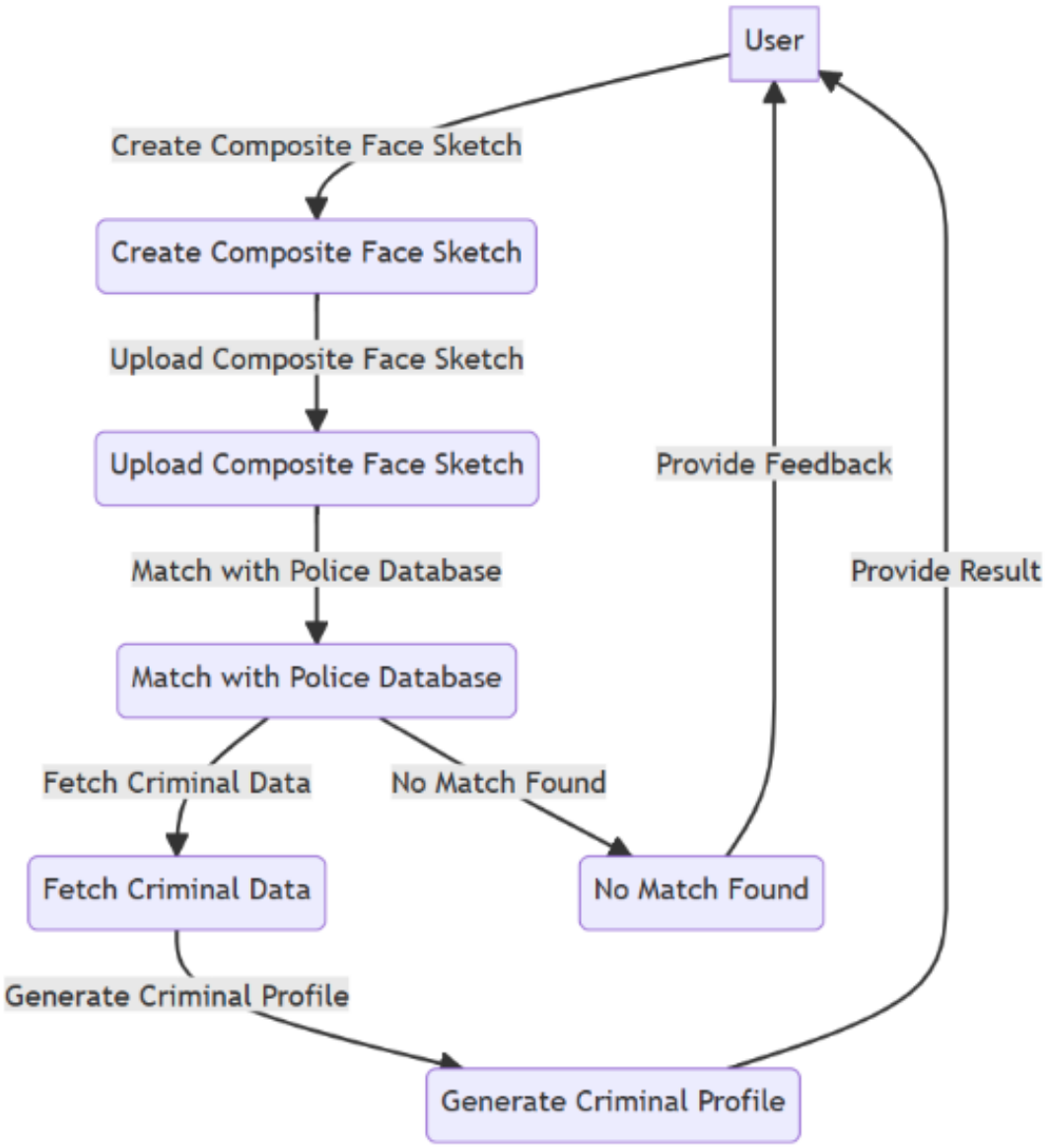


Figure 4.5: DFD Level 1

4.2.3 Data Flow Level 2

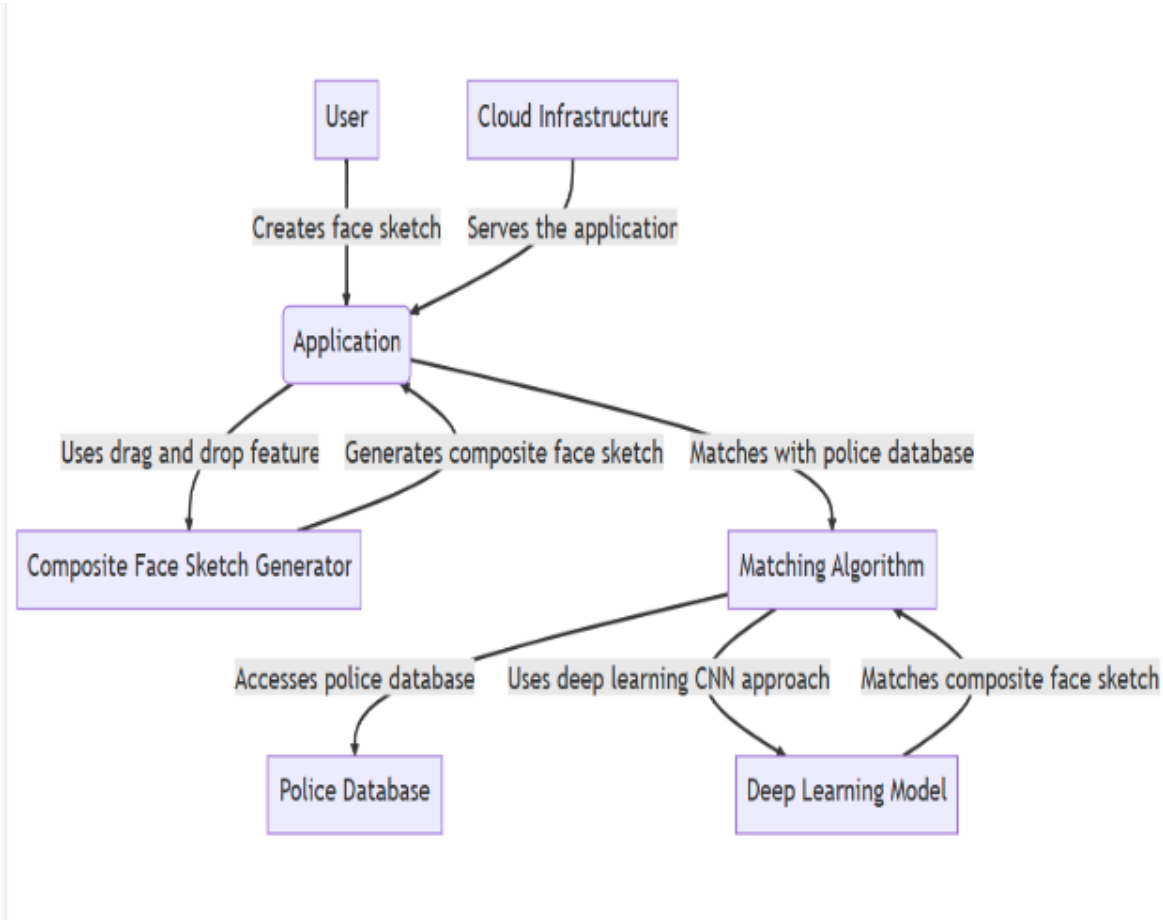


Figure 4.6: DFD Level 2

The above diagrams show the Data flow of the system in three levels which are Level 0, Level 1, Level 2

1. The level 0 shows the overall interaction between the main actors that are sketcher, police hq, criminal. and Admin.

2. The level 1 shows the further interaction for the actors involved in the system.

3. The level 2 shows the in detail working of the system and the interaction between the actors and the sketch construction and recognizing process.

Chapter 5
Design

5.1 Architectural Design

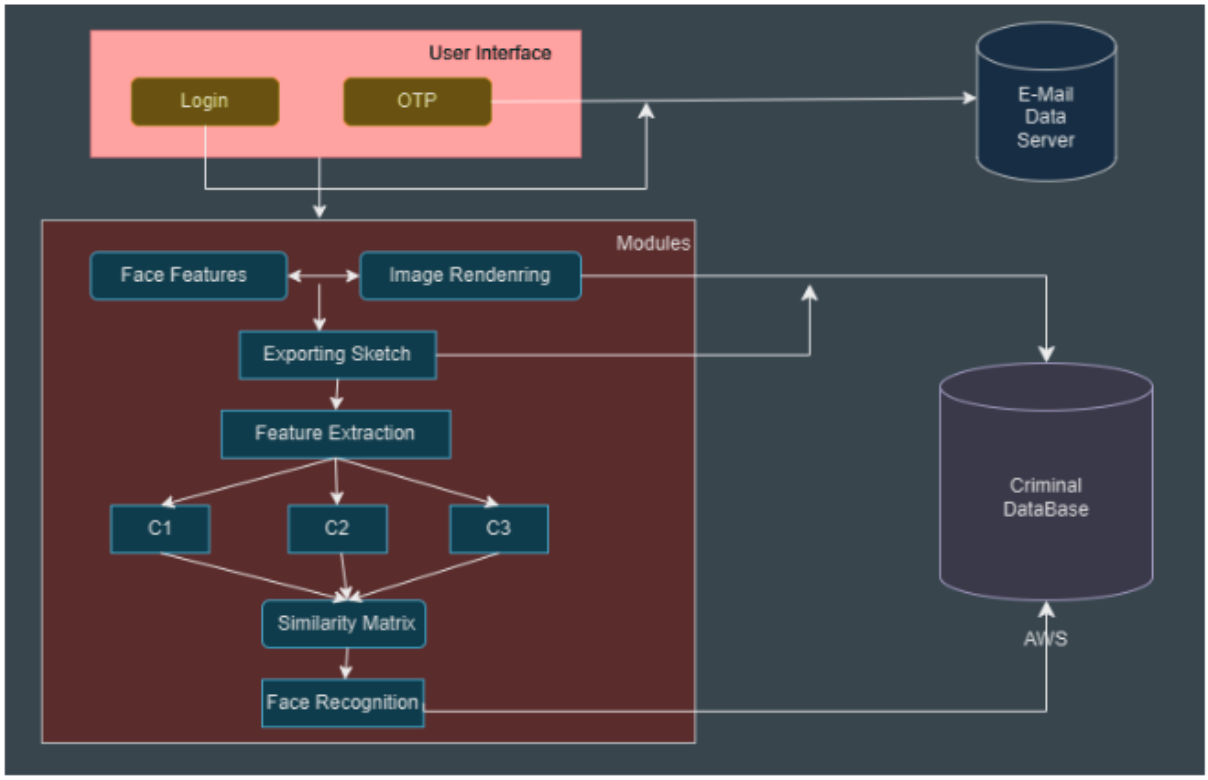


Figure 5.1: Architecture of the System

The proposed Architecture for the Criminal and Culprit Visage system using Java is illustrated in the Figure 5.1 which comprises following components.

1. **User interface**
    - The user interface (UI) provides a login page where users enter their email addresses.
    - After entering the email address, the system sends a One-Time Password (OTP) to the provided email address.
    - The user is prompted to enter the OTP received in their email to verify their identity.
    - Upon successful OTP verification, the user is granted access to the system.
2. **Modules**
    - Face Construction Module :
        - This module is responsible for creating a visual representation of a human face based on extracted features.
        - It uses algorithms to identify facial features such as eyes, nose, and mouth, and renders them to create a face sketch.
        - The module allows users to export the generated face sketch for further use or analysis.
    - Face Recognition Extraction Module :
        - This module focuses on extracting unique features from a face for identification and comparison purposes.
        - It uses algorithms to extract features like the distance between eyes, the shape of the nose, and the contours of the face.
        - These extracted features are used to create a similarity matrix, which is a mathematical representation of the similarity between faces.
3. **EMail Data Server**
    - This server is responsible for sending and receiving emails related to the system's authentication process.

- It stores the OTPs sent to users for verification purposes.
- When a user enters an OTP, the server verifies it to confirm the user's identity.

4. **Criminal Database**

- This database, hosted on an AWS server, stores images and data related to criminals.
- It serves as a repository for criminal image data, which can be used for comparison and identification purposes.

Chapter 6
Implementation

6.1 Algorithms/Methods Used

Our platform was designed and developed using various technology stack in order to provide the law enforcement department with state-of-the-art security features and accuracy which in turn provide the law enforcement department with a better crime solving rate and efficiency.

6.1.1 Machine Locking:

Machine locking ensures that the application, once installed, cannot be tampered with or operated on any other system. It utilizes two locking parameters: HD ID, which is the volume serial of the hard drive with the OS, and NET ID, the hardware ID or MAC Address. This technique enhances security and ensures that the application runs only on authorized machines.

6.1.2 Evaluation and Testing

Evaluate the system's accuracy in recognizing suspects from composite sketches compared to traditional methods, measuring precision, recall, and F1-score. Assess the system's efficiency, measuring the time re-quired for composite sketch creation and recognition.

6.1.3 CNN (Convolutional Neural Network)

CNNs have been particularly successful in image-related tasks due to their ability to automatically learn hierarchical representations from raw pixel data. When applied to facial recognition and sketch construction, CNNs can effectively capture intricate features of faces, such as facial contours, textures, and patterns. CNNs are commonly used, other deep learning architectures such as Generative Adversarial Networks (GANs) and Variational Autoencoders (VAEs)

have also been employed for similar tasks in facial recognition and sketch construction. The choice of algorithm depends on factors such as the specific requirements of the task, available data, and computational resources.

6.1.4 GNN (Generative Adversarial Networks)

GAN - Generative Adversarial Networks (GANs) are a powerful class of neural networks that are used for an unsupervised learning . GANs are made up of two neural networks, a discriminator and a generator. They use adversarial training to produce artificial data that is identical to actual data. The Generator attempts to fool the Discriminator, which is tasked with accurately distinguishing between produced and genuine data, by producing random noise samples. Realistic, high-quality samples are produced as a result of this competitive interaction, which drives both networks toward advancement.GANs are proving to be highly versatile artificial intelligence tools, as evidenced by their extensive use in image synthesis, style transfer, and text-to-image synthesis. They have also revolutionized generative modeling.

6.1.5 Principal Component Analysis

Principal component analysis, or PCA, is a dimensionality reduction method that is often used to reduce the dimensionality of large data sets, by transforming a large set of variables into a smaller one that still contains most of the information in the large set. Reducing the number of variables of a data set naturally comes at the expense of accuracy, but the trick in dimensionality reduction is to trade a little accuracy for simplicity. Because smaller data sets are easier to explore and visualize, and thus make analyzing data points much easier and faster for machine learning algorithms without extraneous variables to process. So, to sum up, the idea of PCA is simple: reduce the number of variables of a data set, while preserving as much information as possible.

6.1.6 Deep Learning for Face Recognition:

Face recognition is the task of identifying and verifying people in photographs by their faces. Deep learning methods, particularly Convolutional Neural Networks (CNNs), have revolutionized face recognition by learning rich and com-

pact representations of faces from large datasets. These methods have achieved accuracy levels comparable to or surpassing human performance in face recognition tasks.

6.1.7 Recognition and Matching

Utilize the CNN models for extracting features from the generated composite sketches.Develop a feature matching algorithm to compare the extracted features from composite sketches with the features extracted from the photo database. Calculate confidence scores for potential matches, allowing law enforcement officers to prioritize and verify results.

6.1.8 Code Snippet for Sketch Uploading

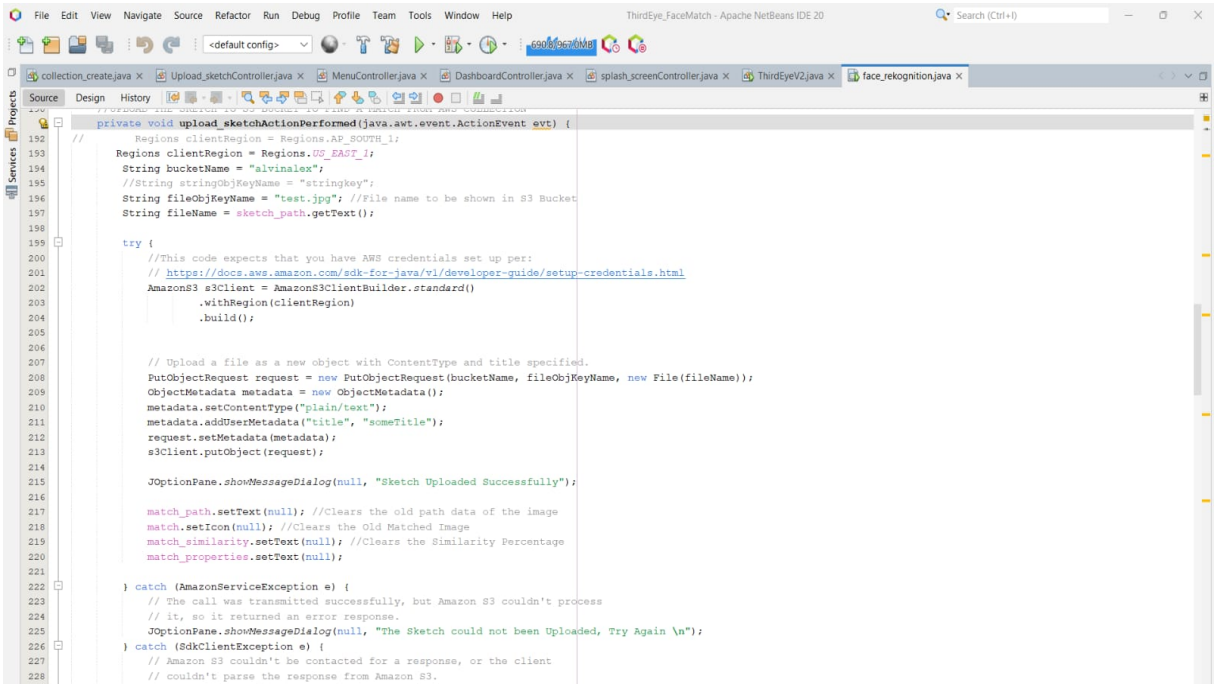
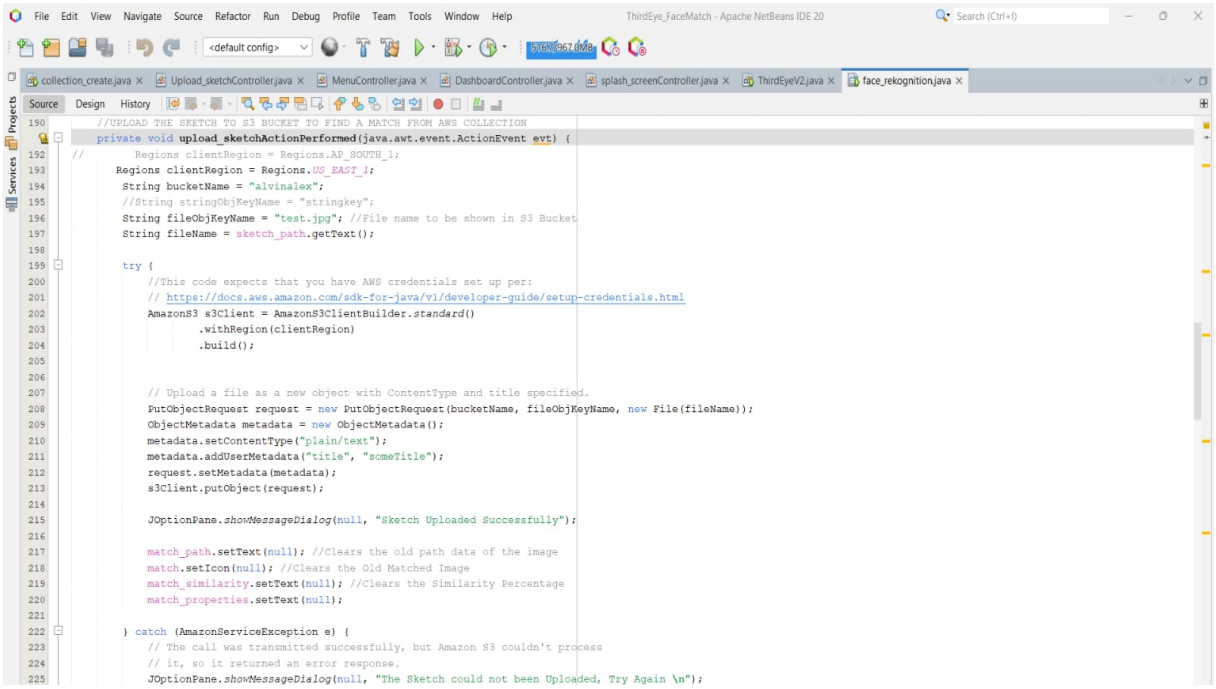


Figure 6.1: Sketch uploaded successfully

The above code snippet representing that the sketch is uploaded successfully and in this sketch is directly uploaded in the cloud by using AWS services.

6.1.9 Code Snippet for Sketch Opening



```
//UPLOAD THE SKETCH TO S3 BUCKET TO FIND A MATCH FROM AWS COLLECTION
private void upload_sketchActionPerformed(java.awt.event.ActionEvent evt) {
//        Regions clientRegion = Regions.AP_SOUTH_1;
      Regions clientRegion = Regions.US_EAST_1;
       String bucketName = "alvinalex";
       //String stringObjKeyName = "stringkey";
       String fileObjKeyName = "test.jpg"; //File name to be shown in S3 Bucket
       String fileName = sketch_path.getText();

       try {
           //This code expects that you have AWS credentials set up per:
           // https://docs.aws.amazon.com/sdk-for-java/v1/developer-guide/setup-credentials.html
           AmazonS3 s3Client = AmazonS3ClientBuilder.standard()
                   .withRegion(clientRegion)
                   .build();


           // Upload a file as a new object with ContentType and title specified.
           PutObjectRequest request = new PutObjectRequest(bucketName, fileObjKeyName, new File(fileName));
           ObjectMetadata metadata = new ObjectMetadata();
           metadata.setContentType("plain/text");
           metadata.addUserMetadata("title", "someTitle");
           request.setMetadata(metadata);
           s3Client.putObject(request);

           JOptionPane.showMessageDialog(null, "Sketch Uploaded Successfully");

           match_path.setText(null); //Clears the old path data of the image
           match.setIcon(null); //Clears the Old Matched Image
           match_similarity.setText(null); //Clears the Similarity Percentage
           match_properties.setText(null);

       } catch (AmazonServiceException e) {
           // The call was transmitted successfully, but Amazon S3 couldn't process
           // it, so it returned an error response.
           JOptionPane.showMessageDialog(null, "The Sketch could not been Uploaded, Try Again \n");
```

Figure 6.2: Sketch opened from file

The above code snippet representing that the sketch is open from the path given by the user which after that carried for matching from criminal face.

We define a function identifycriminal(image path) to load an image from a provided path, detect faces in the image, and then perform further processing to match those faces with a criminal face database.

The iscriminal(face image) function is a placeholder for comparing the detected face with a criminal face database. This function would typically involve more complex logic, such as comparing facial features or using machine learning models for identification.

6.2 Working of the project

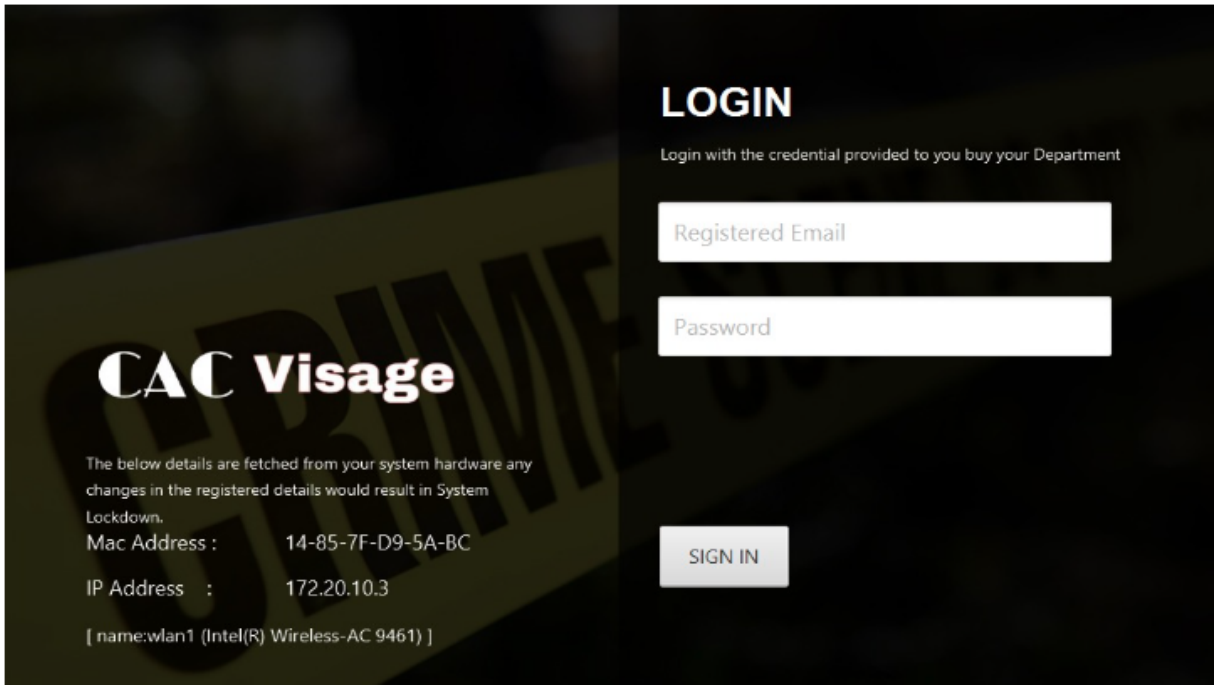


Figure 6.3: Login page

The above **Figure 6.1** represents the login page of the system which is used for identification of the user's.

Figure 6.4: Create and upload page

The above **Figure 6.2** shows it is the second page of the system from which two pages will be directed one Create and other for Upload.

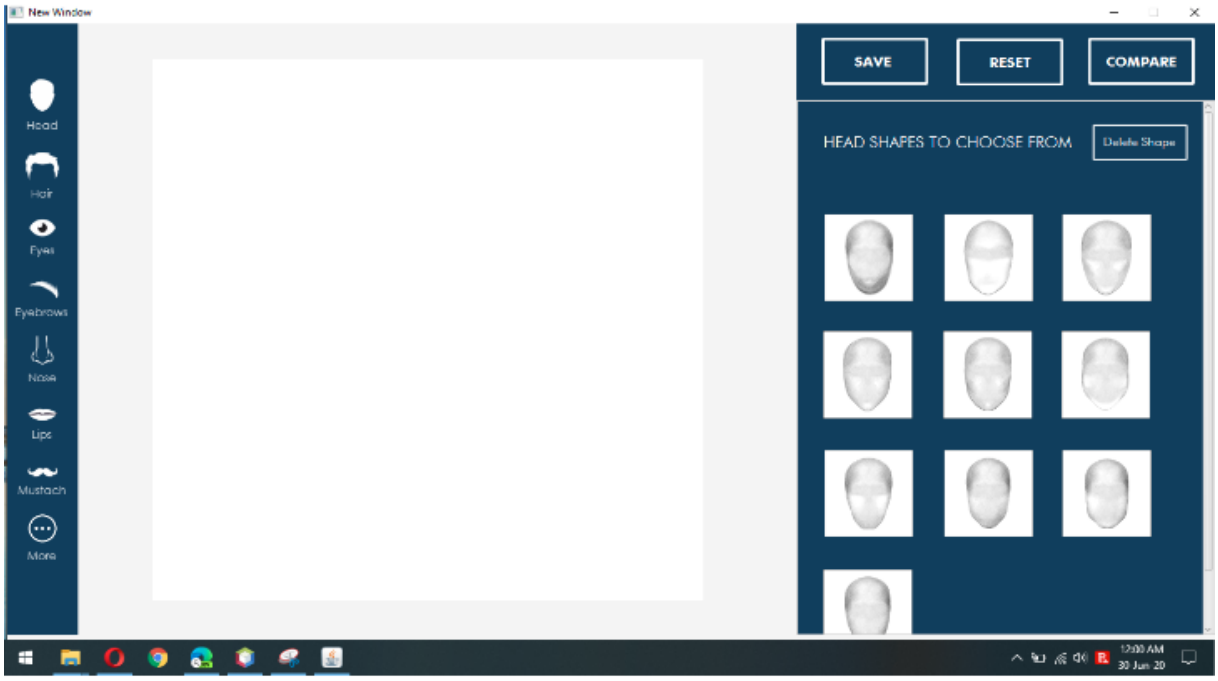


Figure 6.5: Sketch page

The above **Figure 6.3** shows sketch page where user can create a face sketch according to vintners.

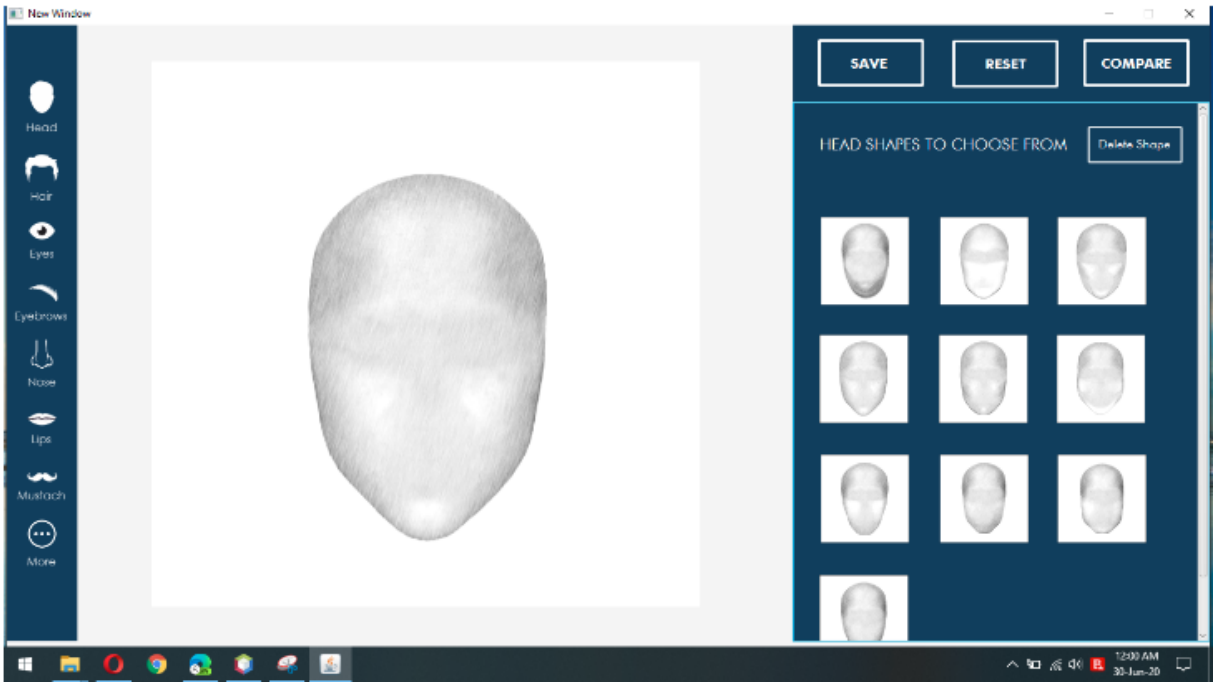


Figure 6.6: Face sketch

The above **Figure 6.4** shows the page from where user can fetch the head shape of the culprits according to the vintners.

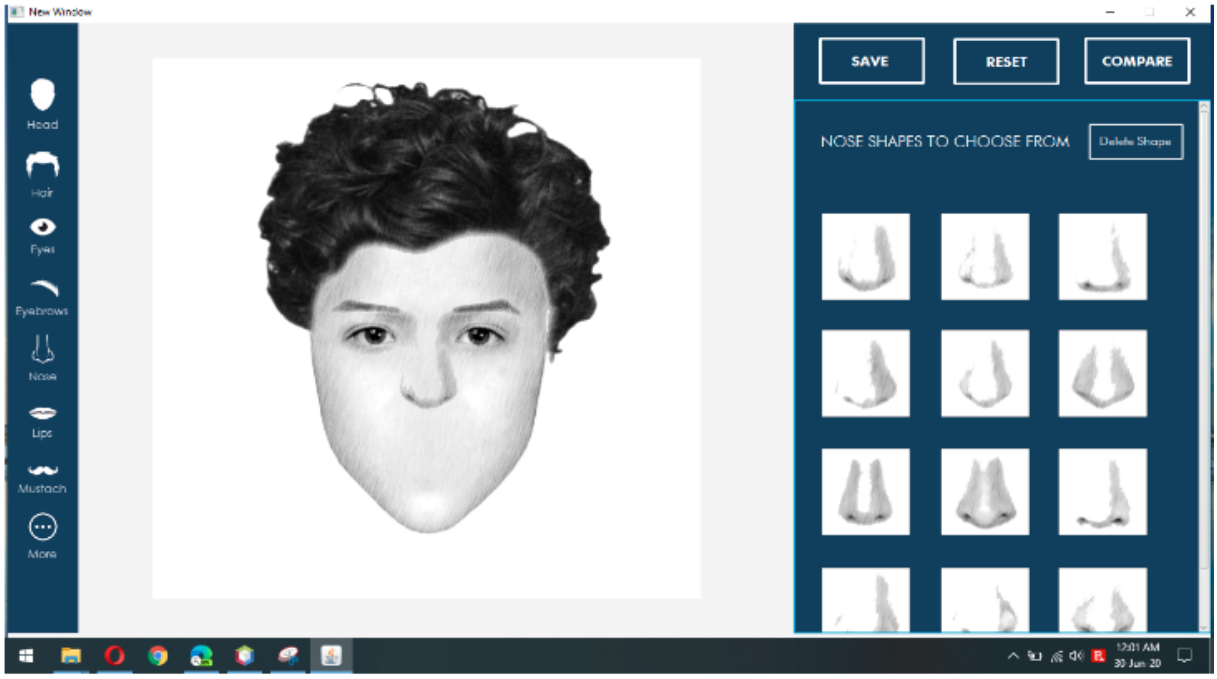


Figure 6.7: hair sketch

The above **Figure 6.5** the partial face of culprit where user pasted hair on the head and eye on face.

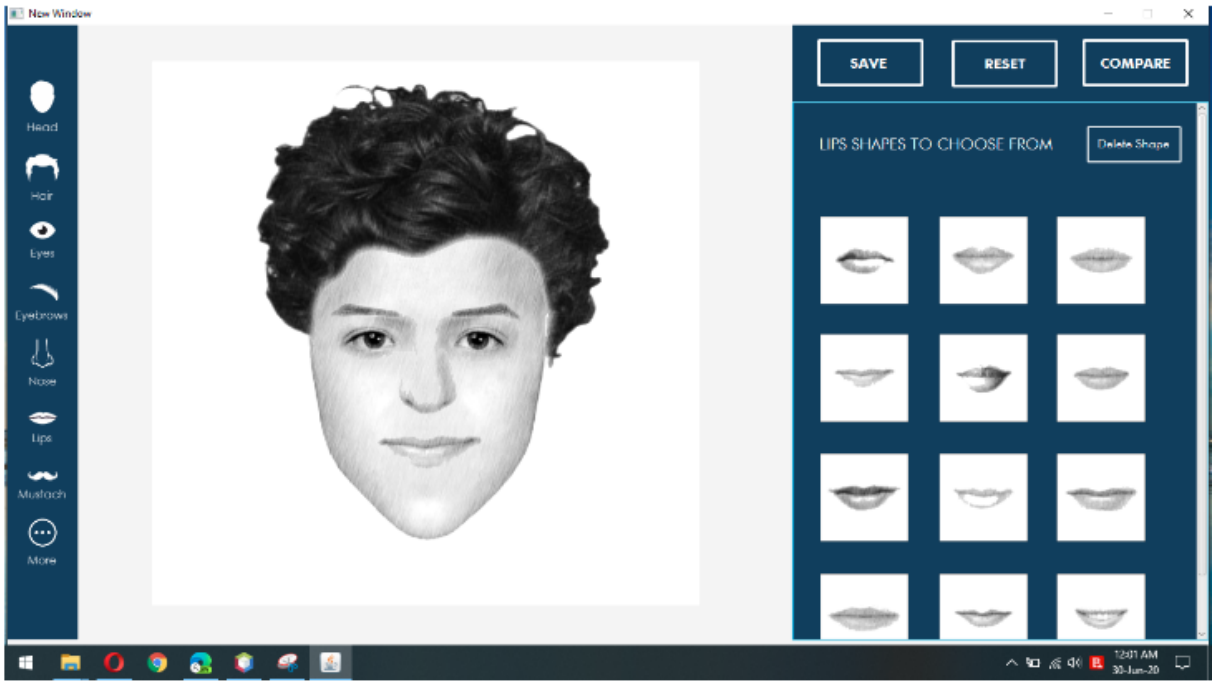


Figure 6.8: eye sketch

The above **Figure 6.6** shows the picture where the user pasted mouth and nose on the face which almost completed the face.

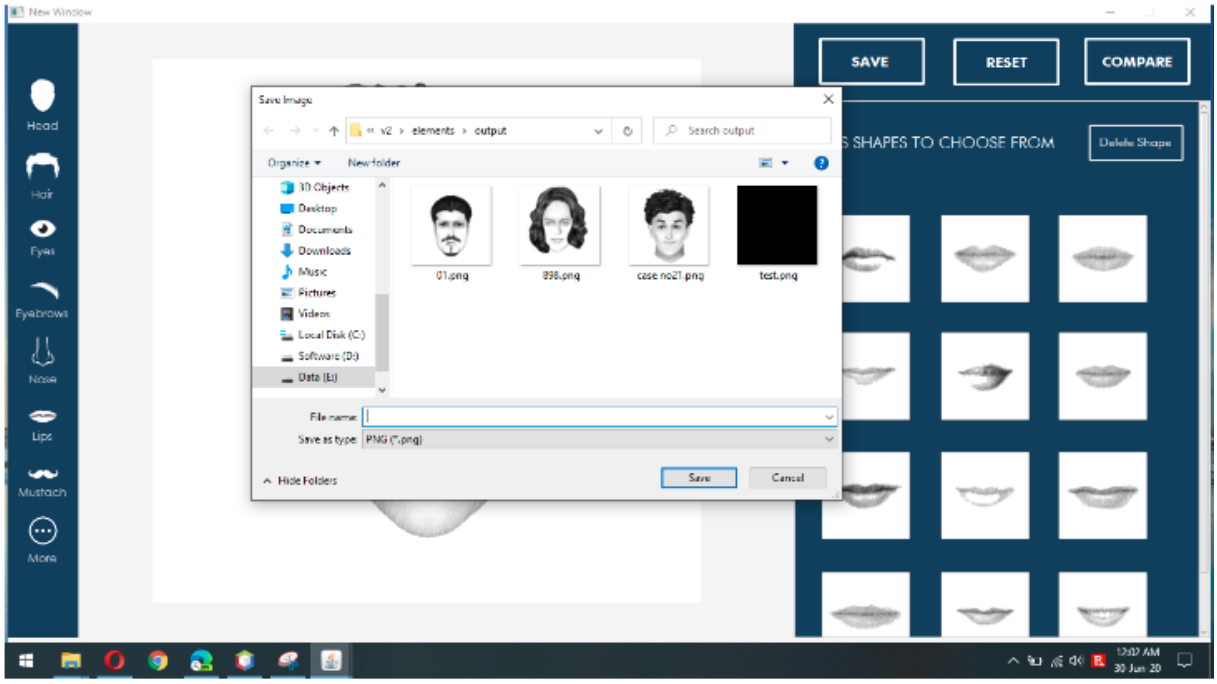


Figure 6.9: fetching from system

The above **Figure 6.7** shows the page where the user can save the face created by him or her in png file.

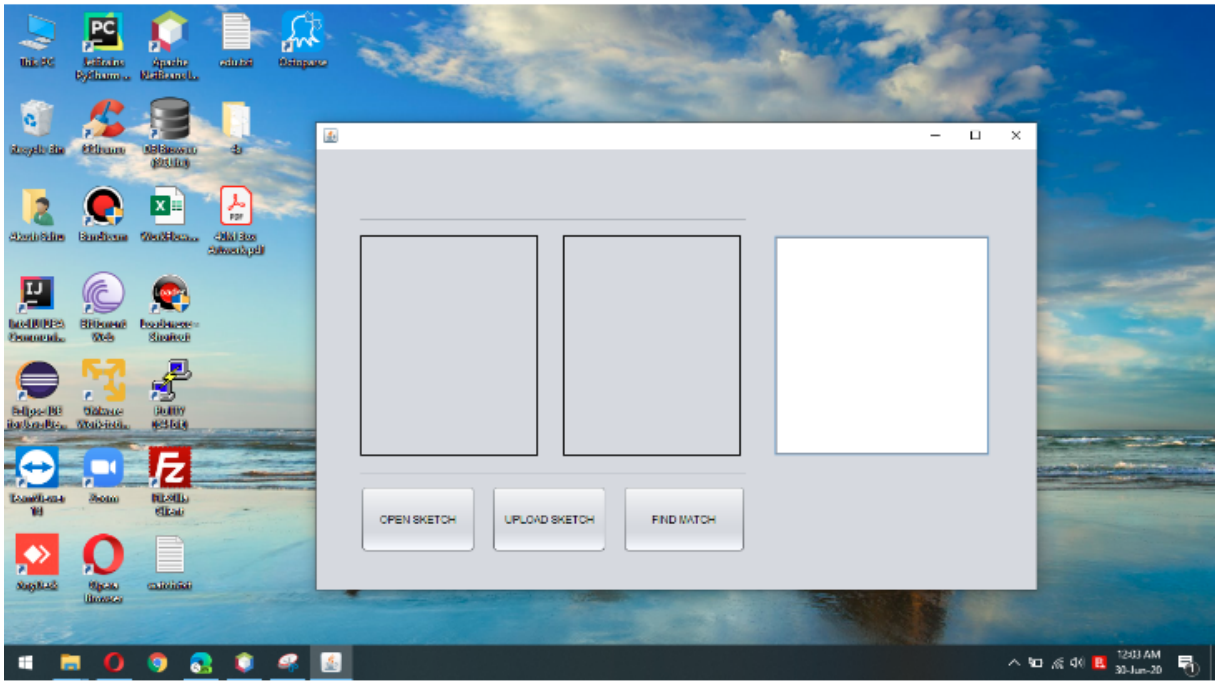


Figure 6.10: fetching page

The above **Figure 6.8** shows the page where user can upload the face of the culprit for matching form police database.

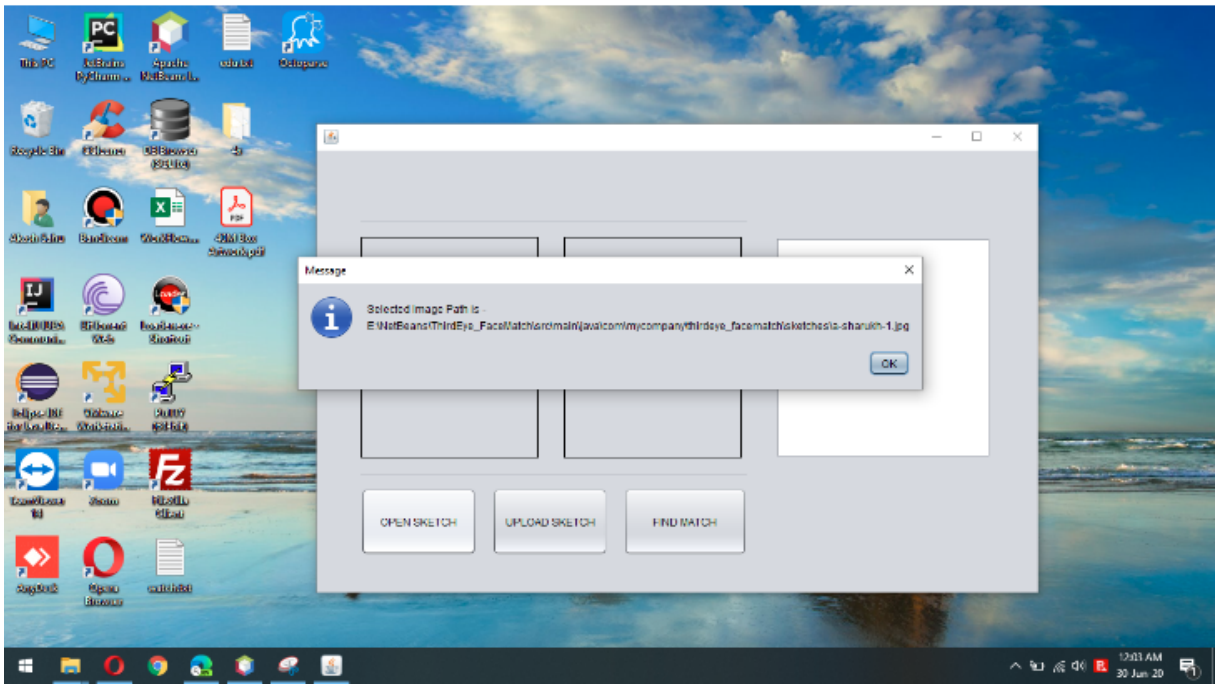


Figure 6.11: fetched image from system

The above **Figure 6.9** shows the page where the system acknowledged the user that the face sketch is uploaded successfully.

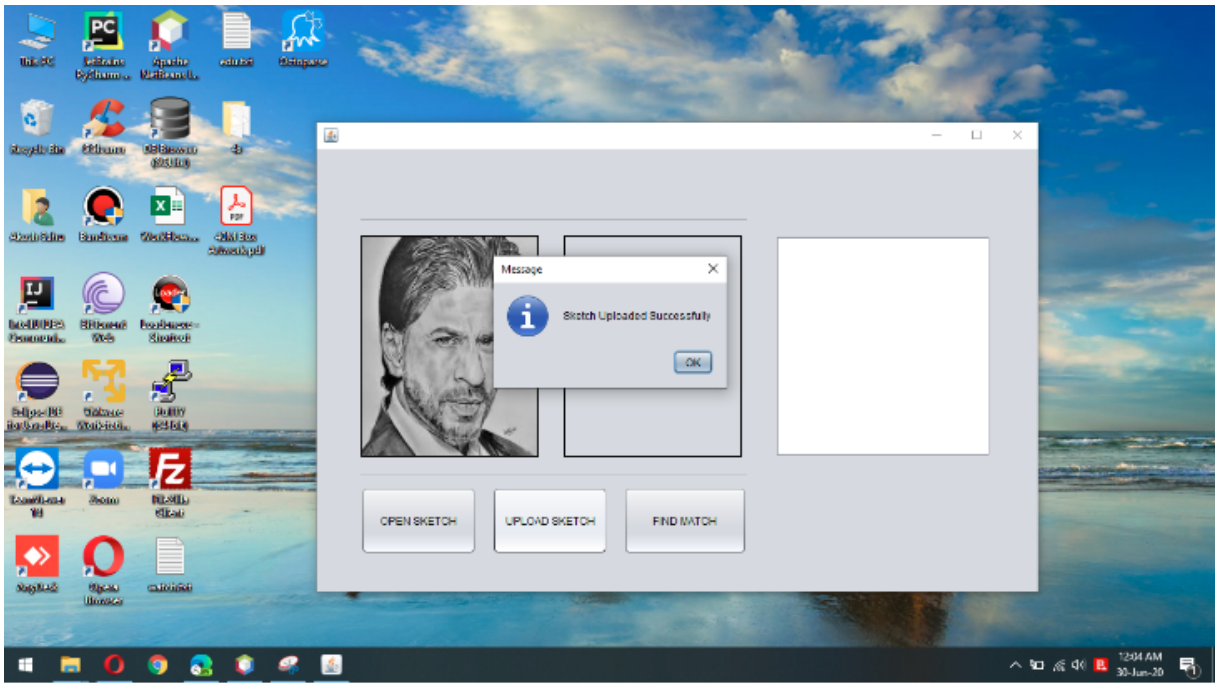


Figure 6.12: Not found data

The above **Figure 6.10** shows the page where the system acknowledged to the user that the uploaded file is not present in the police database.

Chapter 7
Results and Discussions

7.1 Results and Evaluation

After mapping the sketch and matching the face sketch with the records and finding a match the platform displays the matched face along with the similarity percentage and other details of the person from the records. The platform displaying all this and the matched person is shown in the below figure.

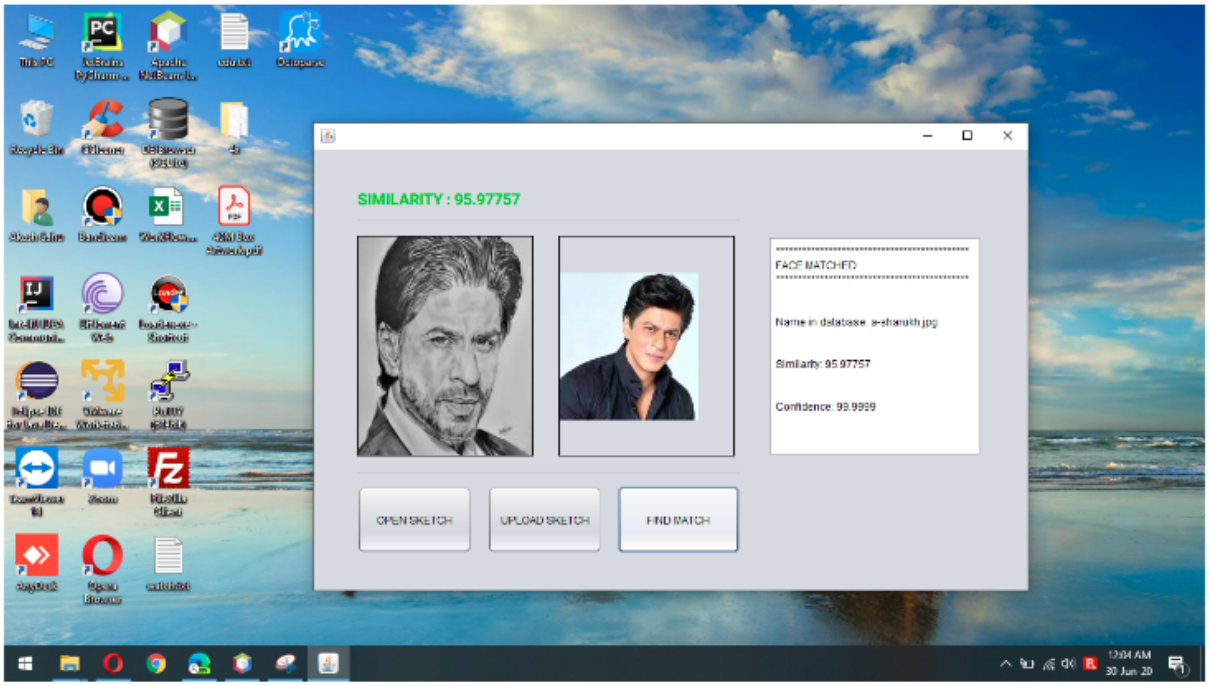


Figure 7.1: Matched face

The above **Figure 7.1** After mapping the sketch and matching the face sketch with the records and It did not find the match and showed the page where it acknowledged the user that the uploaded sketch is not in the police database. First of all, it accepts the uploaded sketch and links it with a police database where it will try to find the match for the uploaded sketch with some similarities.

If a person is not in the database then it will display the user that “Not in the database”. The platform displays the all this in the figure below.
Accuracy of the system is approximate 98 percent which means that the if our system runs for 100 faces then it definitly gives correct similarity for 97 to 98 faces.

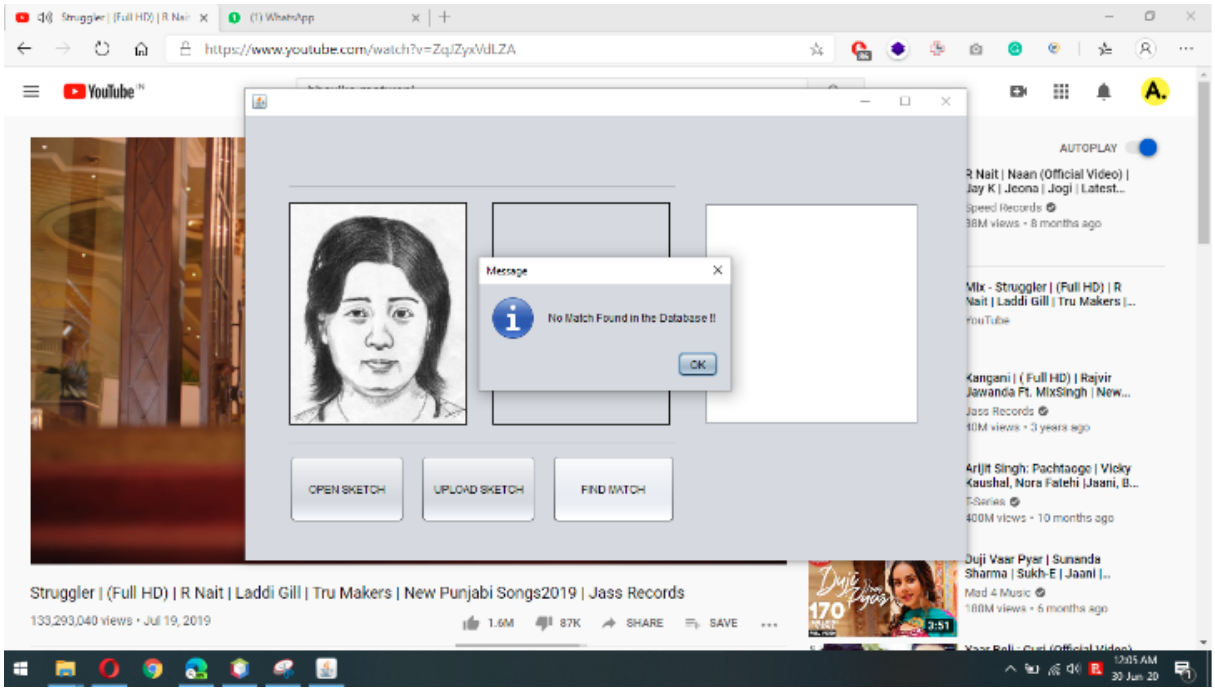


Figure 7.2: Not matched face

During this process, it provides informative messages to keep the user informed about the progress. Once the analysis is complete, the program delivers the results, alerting the user if a match with a known criminal face is found or informing them if no match is detected. It concludes with a closing message, expressing gratitude to the user for utilizing the system and encouraging them to continue their efforts in ensuring public safety.

```
- Get Image from https://alvinalex.s3.amazonaws.com/a-sharukh.jpg
  ------------------------------------------------------------------------
  BUILD SUCCESS
  ------------------------------------------------------------------------
  Total time:  01:42 min
  Finished at: 2024-05-06T18:29:19+05:30
  ------------------------------------------------------------------------
```

Figure 7.3: builded successfully

Additionally, error handling is implemented to notify the user if there’s an issue loading the image file. Overall, the completion of the program enhances user

engagement through interactive prompts, informative feedback, and encouraging messages, thereby creating a more user-friendly and effective Criminal Face Identification System.

Figure 7.4: Completion of program

Chapter 8
Conclusions

8.1 Conclusion

The Project 'Forensic Face Sketch Construction and Recognition' has been designed, developed and finally tested keeping the real-world scenarios from the very first splash screen to the final screen to fetch data from the records keeping security, privacy and accuracy as the key factor in every scenario.
The platform displayed a tremendous result on Security point of view by blocking the platform use if the MAC Address and IP Address on load didn't match the credentials associated with the user in the database and later the OTP system proved its ability to restrict the use of previously generated OTP and even generating the new OTP every time the OTP page is reloaded or the user tries to relog in the platform.
The platform even has features which are different and unique too when compared to related studies in this field, enhancing the overall security and accuracy by standing out among all the related studies and proposed systems in this field.

8.2 Future Scope

The Project 'Forensic Face Sketch Construction and Recognition' is currently designed to work on very few scenarios like on face sketches and matching those sketches with the face photos in the law enforcement records. The platform can be much enhanced in the future to work with various technologies and scenarios enabling it to explore various media and surveillances medium and get a much wider spread and outputs, The platform can be modified to match the Face sketch with the human faces from the video feeds by using the 3D

mapping and imaging techniques and same can be implemented to the CCTV surveillance to perform face recognition on the Live CCTV footage using the Face Sketch. The platform can further be connected to social media has social media platforms acts has a rich source for data in today's world, this technique of connecting this platform with the social media platform would enhance the ability of the platform to find a much more accurate match for the face sketch and making the process much more accurate and speeding up the process. In all the platform could have features which could be different and unique too and easy to upgrade, when compared to related studies on this field, enhancing the overall security and accuracy by standing out among all the related studies and proposed systems in this field.

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Sincerely,

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