A Project Report

on

FINDING MISSING PERSON USING AI

Submitted in partial fulfillment of the
Requirement for the award of the degree of

Bachelor of Technology in Computer Science and Engineering

GALGOTIAS UNIVERSITY
(Established under Galgotias University Uttar Pradesh Act No. 14 of 2011)

Under The Supervision of
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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
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DECEMBER,2021

SCHOOL OF COMPUTING SCIENCE AND ENGINEERING
GALGOTIAS UNIVERSITY, GREATER NOIDA

CANDIDATE’S DECLARATION

We hereby certify that the work which is being presented in the project entitled **“FINDING MISSING PERSON USING AI”** in partial fulfillment of the requirements for the award of the **BACHELOR OF TECHNOLOGY IN COMPUTER SCIENCE AND ENGINEERING** submitted in the **School of Computing Science and Engineering** of Galgotias University, Greater Noida, is an original work carried out during the period of **JULY-2021 to DECEMBER-2021**, under the supervision of **Dr. Ajay Shanker Singh,Professor, Department of Computer Science and Engineering** of School of Computing Science and Engineering , Galgotias University, Greater Noida

The matter presented in the project has not been submitted by us for the award of any other degree of this or any other places.

18SCSE1010495 - Mayank Kumar Singh
18SCSE1070003 - Pooja Verma

This is to certify that the above statement made by the candidates is correct to the best of my knowledge.

Supervisor

(Dr.Ajay Shanker Singh, Professor)

CERTIFICATE

The Final Project Viva-Voce examination of **18SCSE1010495 - MAYANK KUMAR SINGH, 18SCSE1070003 - POOJA VERMA** has been held on _________________ and his/her work is recommended for the award of **BACHELOR OF TECHNOLOGY IN COMPUTER SCIENCE AND ENGINEERING.**

Signature of Examiner(s) **Signature of Supervisor(s)**

Signature of Project Coordinator **Signature of Dean**

Date:
Place: Greater Noida

Acknowledgement

I would first like to thank my Project Mentor Dr. Ajay Shankar Singh**,** Assistant Professor at GALGOTIAS UNIVERSITY. The door to Professor's office was always open whenever I ran into a trouble spot or had a question about my project. He consistently allowed this project to be my own work, but steered me in the right the direction whenever he thought I needed it.

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At last, we would like to thank our family members and friends for keeping us motivated and inspired to face and win all the challenges throughout the project.

Abstract

Nowadays, to find a missing person is very hard task, although we all are updated by social media, it requires numerous paper work to be done and it is time consuming process and also after doing this hard work, there are not much chances of proper result.

This project gives out a system, which helps both police department and public by speeding up the process of searching using face recognition. Therefore, how this system works is that when the person goes missing the respective guardian of that person can upload the image, which then will get store in our database.

Next is, the face recognition model in our system will find a match of that person in the database. If a match is found, it will be notified to the police and the guardian of that person.

We use AI for comparing facial structure and will use python as programming language for making a GUI based application for uploading a photo of missing person and will use firebase as our database for storing data.

The task of finding missing person is not an easy process to chase the kidnappers and find the victim by people or police department. Various steps of filing a report and hard work isthere, even manual process consumes a lot of time and there is no guarantee of finding the lost person.

This application contains functionality to add complaint of lost person. By using these complaints, Government Officials and local people can put their efforts to find missing person in their areas. To overcome the present problem, an application is made to upload complaints on AWS web server which allows accessing the details by any of the Government Officials and also accessible to local people for matching the faces.

This project matches the image of missing people using Face Recognition on any Android platform and hereby, presenting the solution for the problem. Here, we used three modules, User, Police and Admin for getting the desired results. Database Updates automatically as the user uses the application and deletes unnecessary data.

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Acronyms

B.Tech.	Bachelor of Technology
M.Tech.	Master of Technology
BCA	Bachelor of Computer Applications
MCA	Master of Computer Applications
B.Sc. (CS)	Bachelor of Science in Computer Science
M.Sc. (CS)	Master of Science in Computer Science
SCSE	School of Computing Science and Engineering

CHAPTER-1 Introduction

1.1 Introduction

As we know today, we mostly use face to recognize the person and as the technologies are getting best day by day in the ability of face recognition and detection effortlessly.Face Recognition/detection is a distinctive technology which has grown speedily in recent years. The advancement of Information Technology has led to the formation of new ways of finding missing people. Today, engineers and researchers are putting their efforts to automate the tasks of various manual processes. Some of the applications are presented below to find and save details of missing people.

A report published by National Crime Bureau on October 2019, compared the crime rates that shows around 77%-80%rise in the number of crime cases were observed in the year 2017 as compared to 2016.

According to the data on lost persons in crime rates in India, a total rate of around 2.9 lacs people in 2016, 3 lac people in mid-2017, and 3.48 lac people in 2018-19 have been reported as missing and still the counting continues. A report by Manabi Katoch, published in April 30, 2016, “Lost in 1995, Jyotsna Found her Family in 2016. A big thank to Chandrapur Police”, are the headlines of a report. A person is found after 21 years. This is an emergency in the country to take strict action in crime cases and use technology to take quick actions. These people could have a list of conditions like anxiety, stroke, depression, dementia, anemia or disorder.

Lost person under the influence of kidnappers is a person that likely to have been kidnapped, abducted, raped, murdered or harmed rudely. There could be a number of reasons about their detention against their will and fundamental rights. Some are suspected for people trafficking, beauty, appearance, murder victims, social behavior, etc. They always are at a high risk because they went under threat from the kidnappers or socially unstable person.

An OIC has to measure the rate of risk for the persons and rank them individual threatened missing person case i.e. low, mid, high and very high risk, which depends on the situations i.e. a person lost after Friday evening or night, will going to be graded as less risky because there is no actualthreatto missing person or the community to which the person belongs.

Although, an 8-year-old female should be considered as having more risk because the victim is not secure and may be in serious risk and harm her. For automating the activity of finding missing person, we have developed an android platform-based application. The application will be used by Government Officials as well as common people bywhom they can match faces automaticallywithin minimum time period and less efforts.

Android application is a Java based software program which runs on the Android platform because the Android platform is built for mobiles and tablets. An Android application is basically designed for smartphones, tablets, emulators, PC running on the Android Operating System. The application can be available by developers through their websites, Play Store, or by sharing the .apk file format. These applications are uploaded and published on the Android Market, commonly known as Google Play Store, an online store dedicated to these applications for installing, securing rights and purchasing purpose.

The features of Android Market are both free and premium. These applications are written in the Java programming language, which uses Java core libraries and Java Android libraries. The applications are first compiled to generate .class file to run on the Dalvik virtual machine, which is a virtual machine designed for mobile applications. Android technology used SDK tools for building the applications.

The android SDK includes tools, sample code and relevant files for creating and building mobile applications. Here, we present an android application that works for finding the missing person using facial recognition.Our application will try to reduce the number of missing person cases and makes it easily available to local people also.

Missing People Find, is the application used to search for missing people. It has the features of registering missing people and database for found people is maintained. But there is no feature of matching the faces of missing person. There no form validation applied to check the correctness of information entered by the user.

Missing Person Registration application works the same as Missing People Find, form validation is applied and used effectively but it only saves the details of missing persons and there is no provision of face recognition feature or similar technology.

Find Stolen or Missing People stores the details of missing person and displays the content, but it does not properly upload the images and there is no face recognition found in the application.

Missed person is also a similar type of application which saves the details of missing person in low quality images and face recognition system is also not present in it. These related works showed thatthese applications are not sufficient to find the missing person and work in the field of real time applications. So, there are some steps taken to work in the field of missing persons and decreasing the crime rate but these applications are not sufficient to fullfill the current scenario of the nation.

Therefore, there is a need for automation which automates the task of recognizing the missing person. The server provides a system for saving the images and corresponding details of the missing person. By doing this, we can grab the details of all the missing person at that instant. Many applications are providing the service of saving details to the database, but they are not effective to give proper details and takes more time to give the results. Servers like AWS, Alibaba, etc. can be used to store the details of the missing person.

The project on finding Missing Person named as Missing Person, using Face Recognition on Android platform presents a solution for the current problem. Facial recognition works by saving the coordinate points of faces in two dimensional arrays and then matches these points with the face points of searched person.

If at least 70-75 percent of points are matched then, it declares as faces matched. It is a process that uses an android mobile for uploading images into the application, results are obtained on the basis of face recognition. We are using Dlib and Face recognition libraries of python for comparing the faces from saved faces and found person.

The system ensures 70- 80 percent result on the basis of compared faces of missing person. We are using three modules of User, Police and Admin for getting the desired results. Database Updates automatically and deletes solved cases data.

The presented system helps to find out missing person in minimum tenure and less efforts. The application interface is easy to use and free which makes it worth to present in front of others. It also removes the manual system of registering the cases of missing person, hence saving the time.

The aim here is to build a project to find missing person, which will be very convenient to common people as well as police department so that they can find their loved ones within short span of time.

Physically it takes huge time, as it is lengthy procedure for finding missing person as it increases time to launch an FIR in police station. Also during handy process workforce for searching missed person is not so great and due to this half of the cases remain mysterious.

Few existing application does not convey the proper information about the lost person, which is, they only give the database of missing person. In some amusement parks and other public places, they use RFID chip for searching people. To overcome from this, we have proposed new system in which we will also add image of person so that it will be easy to find.

In our project, we come up with the entire database of the missing person, so that the police can trace about the missing person or the guardian can file a case concern to the issue, also person can upload an image of the missing person.

This image will collate with the images in the database and result will be displayed.

We make this whole process very simple. So, here is what we did

1. Designed a GUI application using Python which can be used by Police to register a new case. In the backend, the image submitted is of the missing person is processed and facial key points are captured and stored in Database along with other information like name, father's name, age, city, etc.

2. Designed an Android Application that can be used by common people (people like us). We can use this application to submit a person's picture whom we might find suspicious. We can submit the picture anonymously or with little information. This picture is stored in the database along with the location.

3. The GUI application uses Machine Learning Algorithm to match the pictures uploaded by Police and pictures submitted by the user. If any match is found then we can show it along with the location where the missing person was seen last.

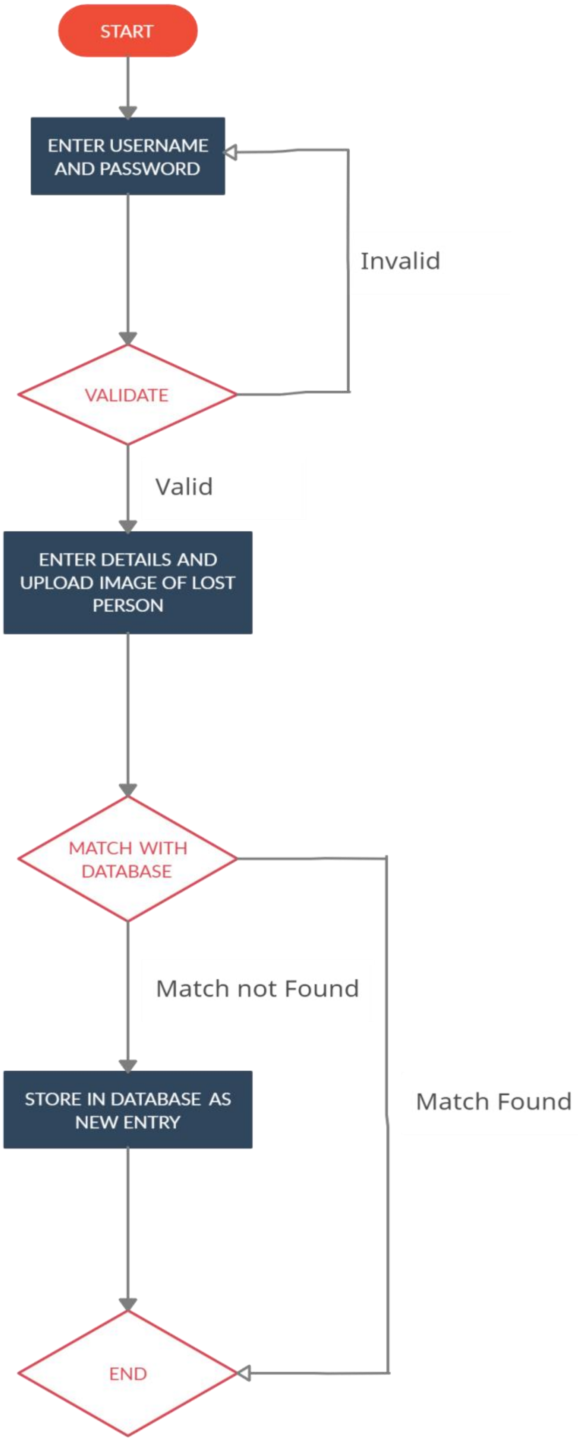
START
ENTER USERNAME AND PASSWORD
Invalid
VALIDATE
Valid
ENTER DETAILS AND UPLOAD IMAGE OF LOST PERSON
MATCH WITH DATABASE
Match not Found
STORE IN DATABASE AS NEW ENTRY
Match Found
END

Figure 1:Flow of System

1.1.1Artificial Intelligence Face Recognition

Facial recognition technology is a set of algorithms that work together to identify people in a video or a static image. This technology has existed for decades, but it has become much more prevalent and innovative in recent years.

One such innovation is the integration of **artificial intelligence** (AI) within facial recognition systems. Intelligent, AI-based software can instantaneously search databases of faces and compare them to one or multiple faces that are detected in a scene. In an instant, you can get highly accurate results – typically, systems deliver **99.5%** accuracy rates on public standard data sets.

AI face recognition software has the following advantages:

- Real-time identification;
- Anti-spoofing measures;
- Lessened racial or gender bias due to model training across millions of faces;
- Can be used across multiple cameras.

WHAT IS AI?

Artificial Intelligence (AI) is a vast subset of computer science revolving around the development of smart machines that can perform tasks that typically need some semblance of human intelligence. It is a multi-faceted, interdisciplinary science, but modern advancements in deep learning and machine learning are bringing it into nearly every area of the tech industry.

1.1.2 WHAT IS DEEP LEARNING?

Deep learning is a function of AI; it imitates the processing power and pattern-creation capabilities of the human brain and uses those abilities to make decisions. Deep learning is a subset of AI's machine learning, and it has networks that can learn from unstructured or unlabeled data – and it can do so without supervision. Deep learning is also referred to as a "deep neural network" or "deep neural learning."

HOW AI FACIAL RECOGNITION WORKS

The basic way that AI in facial recognition works is that you begin with a tagged feature set. Essentially, you are starting with photos that have existing, hand-matched correlations to the people involved. There needs to be an initial, manual correlation between a person's face and the rest of their identity. And once that gets started, it becomes steadily easier to identify faces in pictures of people "in the wild" – so to speak, in which pictures that aren't as clear are matched to that data set.

Each person's face is broken up into numerous datapoints; these can be the distance between the eyes, the height of the cheekbones, the distance between the eyes and the mouth, and so on. AI facial recognition searches on those datapoints and tries to account for variations.

And how, exactly, is AI able to recognize faces? Well, each person's face is broken up into numerous data points; these can be the distance between the eyes, the height of the cheekbones, the distance between the eyes and the mouth, and so on. AI facial recognition searches on those data points and tries to account for variations (for instance, distance from the camera and slight variations in the angle of the face).

However, even well-trained AI facial recognition systems don't have real-world context and can be fooled. If you see a colleague who is wearing a face mask, sunglasses, and a baseball cap, you may still recognize them. An AI system, however, might not. It depends on level of training the neural network. Even though AI facial recognition systems are more superficially accurate, it is also easier for them to blunder under less-than-ideal conditions.

For a deeper look at how AI facial recognition works, **check out this video** from IDG TECHtalk. https://www.youtube.com/watch?v=aLkSq8SEOnU

WHERE IS FACE RECOGNITION AI USED TODAY?

Face recognition AI is applied to many industries nowadays. For instance:

- **Health care.** Computer vision is combined with AI to support pain management procedures and track patient medication consumption.
- **Security.** Deep learning algorithms are helping to reduce the need for regular passwords on mobile devices, recognize fraud detection, and improve anti-spoofing capabilities.
- **Airport boarding:** Each year, over 100,000,000 people pass through Paris' Orly and Charles de Gaulle airports. To speed things up, the airports have begun using "smart gates," which use a combination of facial identification and liveliness checks.
- **Proctoring:** Some proctor services use AI solutions to detect and document suspicious behavior via webcam monitoring. Live proctors can then analyze and contextualize those events.

For more examples of how face recognition AI is used, read our article on the topic.

HOW ARTIFICIAL INTELLIGENCE IS TRAINED FOR FACIAL RECOGNITION

As mentioned earlier in the article, AI face recognition needs to practice on manually selected photosets. Some companies make this easier for AI developers by providing training data for facial recognition systems. Let's look at Lionbridge AI, for instance. According to them, facial recognition models see many calculations instead of a human face.

For security and surveillance purposes, a model can compare those calculations to other face calculations located within a database. But, regardless of the use case, every single AI facial recognition system needs to train with lots of face image data. AI models must be trained with facial images that vary in ethnicity, age, angles, lighting, and other factors.
Sometimes, to build their training datasets, facial recognition companies scrape the open web to gather photos of people without consent. This is highly controversial, and the ethicality of it is brought into question – which we'll take a closer look at next.

Face recognition process

Face recognition is the process of labeling a face as recognized or unrecognized. The process has a life cycle based on a pipeline that goes through collection, detection, pre-processing, and a recognition stage. In the collection step, images are captured and stored for training and recognition. In the detection phase, regions of a face within an image are identified and their location is recorded. The pre-processing stage modifies the image by removing unwanted features such as shadow or excessive illumination. Recognition, the final stage of the pipeline, identifies the face as recognized or not recognized.

Face collection

Before a recognition system can identify a face, it must first be trained on a collection of images, known as the training set. The set enables comparison of its contents with a new image to determine if the difference is small enough for a positive identification. For a successful recognition, the set must be robust, meaning it must contain a variety of images such as facial images (positive samples) as well as non-facial images (negative samples) such as cars, trees, etc. Furthermore, the set must contain a variation of facial images, where the subject is looking up or down, with different facial 6 expressions and lighting conditions. It is important to have variety in the set rather than just a large number of images with little or no variation in them.

Face Detection

Face detection is the process of locating a face in an image without identification. Although many face detection algorithms existed before 2001, a major breakthrough in face detection appeared with the Viola-Jones paper "Rapid Object Detection using a Boosted Cascade of Simple Features" [6]-[7]. Unlike previous face detection methods that relied on pixel analysis, Viola-Jones devised an algorithm called "Haar-classifier" that relied on Haar-like features. The Haar classifier is a machine learning algorithm that is trained with many positive and negative samples to detect objects in images. For the classifier to work properly, the size of the image in the training set must be the same as the size of the input image used for object detection.

Pre-processing

Face recognition algorithms are susceptible to many external effects such as head orientation, partial occlusion, facial expression, and light condition. To minimize these effects on the performance of the algorithm and to reduce error, facial images are preprocessed to make them recognition friendly. A standard pre-processing technique for reducing the effect of light condition is the histogram equalization. The image histogram is produced by a count of pixel values in the range of 0-255. If most of the high bins are to the right of the histogram, the image is bright and if most of the high bins are to the left of the histogram, the image will be dark.

1.2 Problem Statement

A report published by National Crime Bureau on October 2019, compared the crime rates that shows around 77%-80%rise in the number of crime cases were observed in the year 2017 as compared to 2016. The records are enough to take serious actions on the process of solving crimes in the country.

Also, the current scenario of finding missing personis based on manual system which not much efficient to tackle the rapidly increasing cases of missing person. The manual procedure of finding missing person is still a long and time-consuming process. Writing FIR (First Information Report) and then registering to the department book and then circulating it to the other stations takes long time. It wastes the manpower and also the papers.

There are some applications which are used to find the missing person, but some of them just saves the cases to the database and some of them do not works properly. Most of the applications do avails face detection, face recognition features of Artificial Intelligence and Machine Learning. In this context, we have made an application named Missing Person which avails the features of facial recognition, saving cases to the database and matching the corresponding images from the database.

We are using Dlib and Face recognition libraries of python for analyzing missing personfaces,the system ensures 70-80 percent result on the basis of analyzed faces. The server provides a system for saving the images and corresponding details of the missing person.

As explained in this article from Nature.com, there are plenty of questionable ethics involved with the development of AI facial recognition. For instance, researchers at Harrisburg University, PA, developed AI facial recognition software that, in their words, could predict whether somebody was going to become a criminal and with **80%** accuracy. There was a wave of negative reactions, and Harrisburg ended up removing their press release on the topic and did not publish the work.

Another sticky point is the collection of data without consent. Up until the early 2000s, AI developers typically got volunteers to pose for training data. Nowadays, though, the majority of facial images are collected without permission.

For instance, in 2016, researchers from Seattle's University of Washington posted a database that contained **3.3 million** photos of faces scraped from Flickr without consent. Currently, there are no clear legal safeguards regarding the gathering of facial recognition training data – but, recently, Facebook paid a **$650 million** settlement for harvesting facial data.

Some companies, such as Google, have publicly proclaimed that they are taking a more responsible approach to face-related technologies. Some standards include:

- Not amplifying or reinforcing existing biases;
- Not using these technologies in ways that violated internationally-accepted ethical norms;
- Protecting privacy by providing an ideal level of control and transparency.

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- Not amplifying or reinforcing existing biases;
- Not using these technologies in ways that violated internationally-accepted ethical norms;
- Protecting privacy by providing an ideal level of control and transparency.

1.3 Formulation of Statement

The world is growing rapidly and so the level of safety needs to be reorganized. Some applications are made to increase the level of safety, but fails at some point or the other. To tackle the problems in the existing applications, we have developed a simplified android platform-based Application named as Missing Person.

The applications provide the features of adding missing person cases and uploading the image of found person to match it with the images saved in database. In case, the person is unable to identify himself due to the situations faced by the person, this application gives all the details of that person if the details are registered on the database (server).

The application responds from the server in seconds which saves the time of people and making the user interface effective to use.

The application works on any android version ranging from Android 2.1 to Android 10, which is the latest version of Android available in most ofthe devices. Also, it can be as a web application just typing the URL of the website. The web application feature is available to the Django framework of Python.

The proposed system includes the following features. Adding details to the database. Details are name, age, address, contact number, Description, image of the missing person, etc. Details can be fetched using admin panel by an authorized person. After saving the details, image the found person can be uploaded to get the details of the missing person. Notification of updated (added) details.

1.3.1 Presentation Layer It provides the frontend view to show the actual behavior of the application. Mobile phone will work as a client to send the requests to the server. Then server in response, perform the required computation and give back the results.Userwill interact with the presentation layer to use the application. It uses Python Django framework to send and receive the requests.

1.3.2 Business Layer This layer acts as an intermediate between presentation layer and server. It receives requests from client and sends it to the server (database). In return server responds to it and forwards the response to the client. We used amazon web services to provide a server for our application. Amazon EC2 is used to work as compute power and stores our data in database.

1.3.3 Database Layer In Django,the default database used is SQLite. It is beneficial for a smaller number of records. However, the type of database used can be changed according to the requirement. SQLite is faster and efficient to work properly.

Django interacts with the database and modifies it according to the situations. It also gives the advantage of easy upload and retrieve images. Here are some advantages of the proposed system. Easy uploading of images, Simple GUI, Easy information retrieval, For both desktop and mobiles. Disadvantages of the proposed system. Internet connectivity is compulsion. Works with android devices.

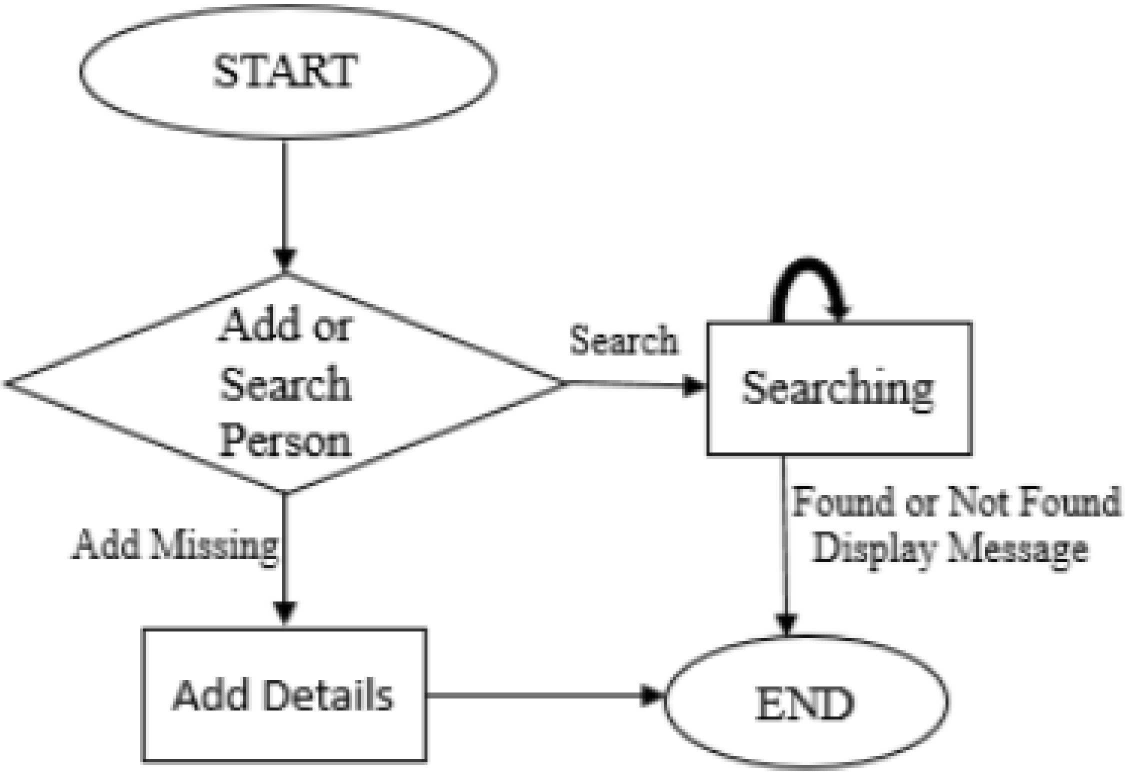


Fig 2: Work Flow Chart

FACIAL FEATURE SEGMENTATION

Facial features can be identified by using geometry and their relative position to one another. For example, the thickness of the eyebrow and its relative position to the eye can be measured to identify its location. Brunelli and Poggio [32] describe a recognition system based on geometrical features to distinguish between faces. They apply a template matching technique to locate a feature, utilizing the knowledge of the average face structure to refine the search for the remaining features. Once all the features are detected, a dimensional vector is created to represent the face. Recognition is then carried out by means of the nearest neighbor classifier. A different approach is presented in this study.

Unlike Brunelli and Poggio, there will be no attempt to make any measurement of facial features. Instead, the facial features are segmented and extracted out of the image and placed in their own data set. Although pre-processing techniques as described in section 1.8 can improve the accuracy of the results, a conscious decision has been made to factor out this step and its influence on the outcome of the face recognition approach.

1 Features and data set

The training data set contained 7 images for each 40 subjects in the AT&T data set without any overlap. Each subject was further divided into the left and the right eye, the nose, the mouth, and the both-eye data sets.

Test images were chosen from the remaining 120 subjects in the AT&T data set. Each of the 40 test subjects were in 3 different poses making up the total 120 images. The feature segmentation algorithm for the test subjects was set to be the same as those for the training set. For example, the procedure to segment a subject's left eye for training was the same as that for testing. Since there is more than one classification of data, i.e. “left eye,” “right eye,” facial feature segmentation provides a better granularity than full face recognition. In the following sections, a discussion of data granularity shows how it can be leveraged to improve recognition accuracy among the Eigen-face, Fisher-face, and LBP algorithms.

2 Feature distribution

The distribution of recognized features varied for each applied recognition algorithm, but it stayed mostly within 1-3 recognition levels as shown in Figures 12-14, 18-20, 23-25, and 30-35. In the figures, the horizontal axis is set to be a common scale for subjects 1 through 40, with their vertical axis displaying how a particular category of data is distributed.

3 Left eye distribution

The left eye distribution is shown in Figures 12, 13, and 14. The Eigen-face and Fisher-face are mostly within 2-3 recognition levels, and LBP is within a 1-2 range.

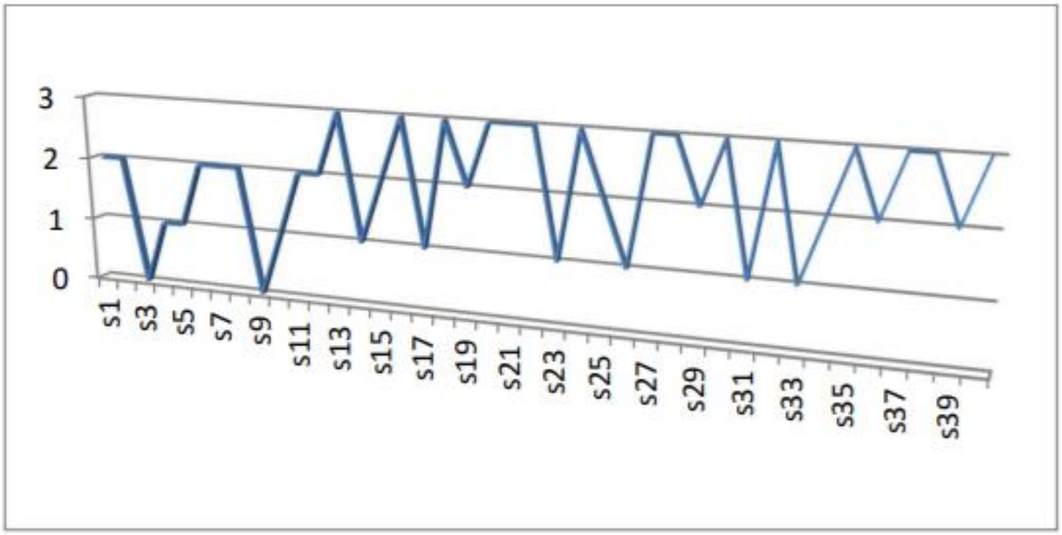


Figure (a). Left eye recognition distribution, Eigen-face algorithm.

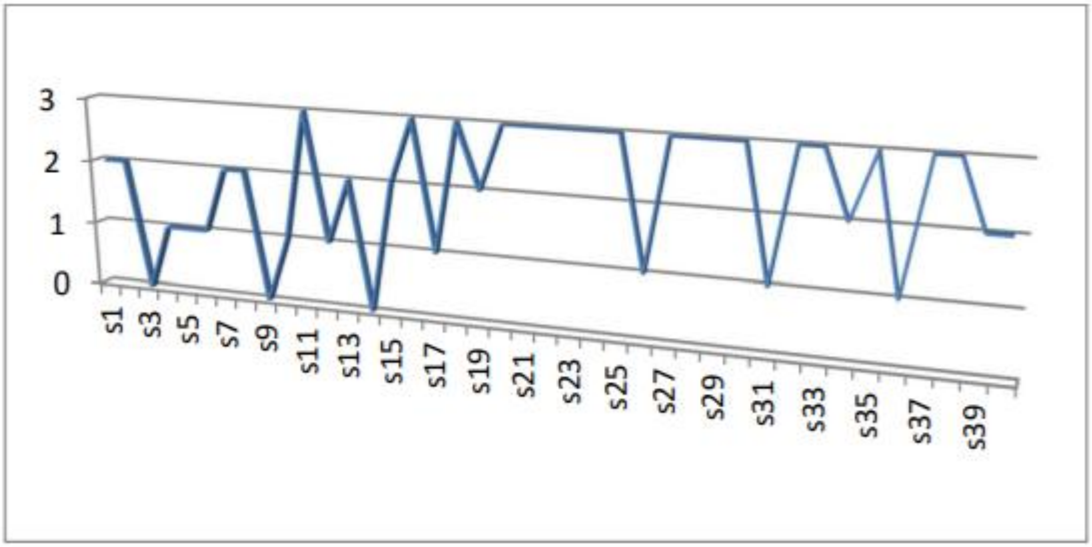


Figure (b) . Left eye recognition distribution, Fisher-face algorithm.

CHAPTER-2
Literature survey

We did lot of survey and summed up following regarding literature survey. So firstly, Students from Centre for development of advanced computing named Pournami S. Chandran and his team gave out a paper, which had same objective. They used Deep Learning (CNN) constructed Facial features extraction with the help of SVM.

This section compares manual system of finding people with automation and a contrast with their related papers. Each year around 1 lac peoples gets missing and from them only some found easily but most of the cases takes much more time even it may lead to the death of the person. So, manually itis a difficult task to find the person as soon as possible.

The manual system takes time to file a case and proceeding the case to execution. Also, manpower is not much efficiently trained to search for the missing effectively. So,there are some steps taken to work in the field of missing persons and for decreasing the crime rate but these applications are not sufficient to fulfil the situation of current scenario.

In Crime Reporter and Missing Person Finder, features like adding and removing complaints, display, search by attributeswere given, but lacking the functionality of facial recognition. Similarly, Missing person Finder papers, the working is confined to entering and updating the details. Most of the papers are similar to the above ones.

Therefore, there is a need for automation which automates the task of recognizing the missing person. The server provides a system for saving the images and corresponding details of the missing person.

By doing this, we can grab the details of all the missing person at that instant. In this context, we have made an application named Missing Person which avails the features of facial recognition, saving cases to the database and matching the corresponding images from the database.

Many applications are providing the service of saving details to the database, but they are not effective to give proper details and takes more time to give the results. Servers like AWS, Alibaba, etc. can be used to store the details of the missing person.

Secondly, in year 2016, Rohit Satle and his team handed out a paper, which says about a face recognition system built using Principal Component Analysis (PCA) method.

Third, Swarna Bai Arniker and the team had given a paper, which labels missing people identification system using RFID Technology.

Fourth, Birari Hetal and his team have presented a paper where they have used SWF-SIFT to compare faces. However, SIFT is computationally heavy and therefore costs lots of time.

As in 2015, Thomas M. Omweri and Andrew M. Kahonge have given out a paper where they put forward a system that uses mobile-based web service to search missing person.

In 2016, Prof. Sumeet Pate and his colleagues presented a paper which shows the use of the Line Edge Method (LEM) for face recognition to find missing people.

Lastly, in year 2018, Peace Muyambo from Zimbabwe suggests a face recognition system to find missing people in Zimbabwe, which used the LBPH method to recognize, face.

Chapter 3
Software and Hardware Requirement

3.1 Software Requirement

- Visual Studio Code
- Android Studio
- AVD for testing
- SDK for API 8 (min) or API 29 (max)
- JDK, Java 7+
- EC2 instance from amazon web services
- Python 3.6 or above
- Django 2+
- Dlib 19+, Face recognition, etc. as required
- 64 bit-Operating System
- Window 7 or above.
- HTML • Gradle 2+

3.2 Hardware Requirement

- Processor of 1.7GHz Processor Pentium 4 or above
- RAM: 1GB, 100GB of hard disk
- Android Mobile with camera

CHAPTER-4
Implementation and Testing

4.1 Implementation Methodology

Model View Controller or MVC as it is popularly called, is a software design pattern for developing web applications. A Model View Controller pattern is made up of the following three parts:

- **Model** - The lowest level of the pattern which is responsible for maintaining data.
- **View** - This is responsible for displaying all or a portion of the data to the user.
- **Controller** - Software Code that controls the interactions between the Model and View.

MVC is popular as it isolates the application logic from the user interface layer and supports separation of concerns. Here the Controller receives all requests for the application and then works with the Model to prepare any data needed by the View. The View then uses the data prepared by the Controller to generate a final presentable response. The MVC abstraction can be graphically represented as follows.

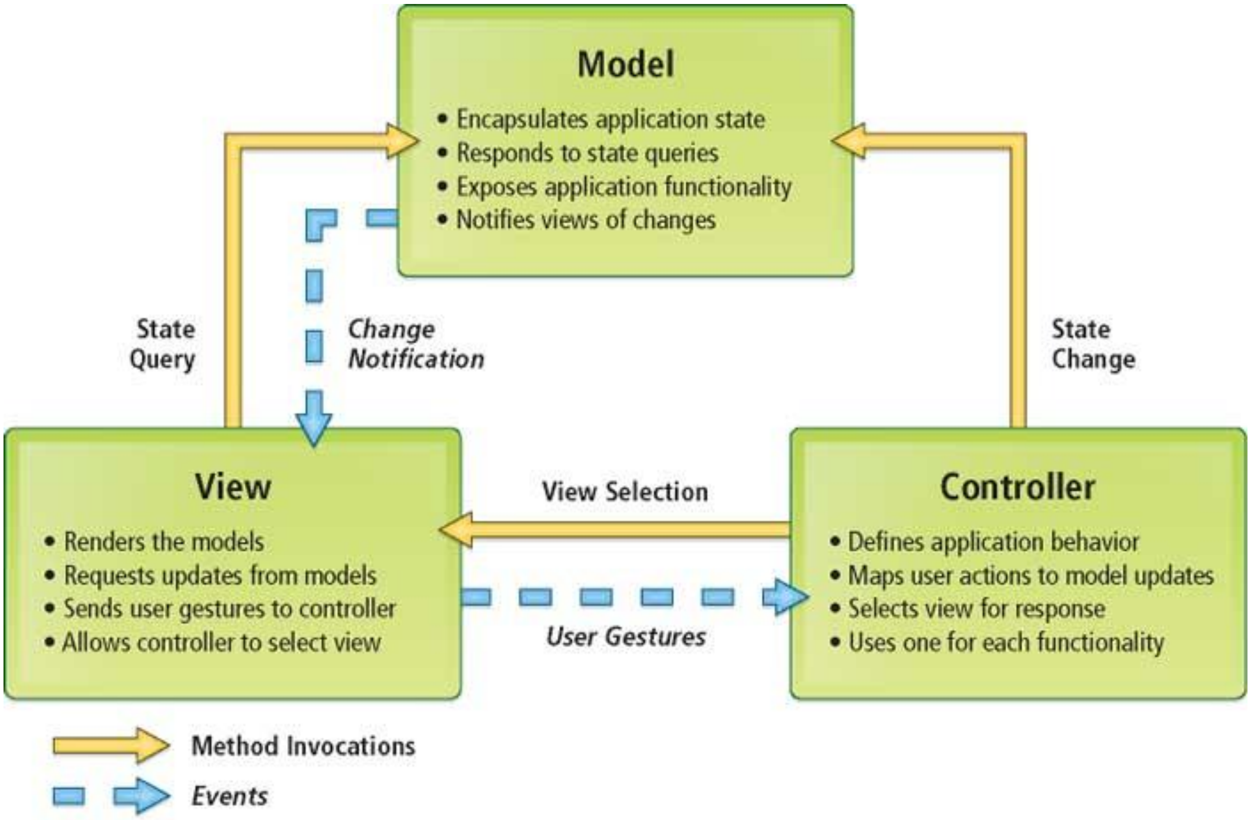

Model
• Encapsulates application state
• Responds to state queries
• Exposes application functionality
• Notifies views of changes
State Query
Change Notification
State Change
View
• Renders the models
• Requests updates from models
• Sends user gestures to controller
• Allows controller to select view
View Selection
User Gestures
Controller
• Defines application behavior
• Maps user actions to model updates
• Selects view for response
• Uses one for each functionality
Method Invocations
Events

Fig. 6: MVC (Model View Controller Flow) Diagram

4.2 Security Testing of the Project

Testing is vital for the success of any software. no system design is ever perfect. Testing is also carried in two phases. first phase is during the software engineering that is during the module creation. second phase is after the completion of software. this is system testing which verifies that the whole set of programs hanged together.

4.2.1 White Box Testing:

In this technique, the close examination of the logical parts through the software are tested by cases that exercise species sets of conditions or loops. all logical parts of the software checked once. errors that can be corrected using this technique are typographical errors, logical expressions which should be executed once may be getting executed more than once and error resulting by using wrong controls and loops. When the box testing tests all the independent part within a module a logical decision on their true and the false side are exercised, all loops and bounds within their operational bounds were exercised and internal data structure to ensure their validity were exercised once.

4.2.2 Black Box Testing:

This method enables the software engineer to device sets of input techniques that fully exercise all functional requirements for a program. black box testing tests the input, the output and the external data. it checks whether the input data is correct and whether we are getting the desired output.

4.2.3 Alpha Testing:

Acceptance testing is also sometimes called alpha testing. Be spoke systems are developed for a single customer. The alpha testing proceeds until the system developer and the customer agree that the provided system is an acceptable implementation of the system requirements.

4.2.4 Beta Testing:

On the other hand, when a system isto be marked as a software product, another process called beta testing is often conducted. During beta testing, a system is delivered among a number of potential users who agree to use it. The customers then report problems to the developers. This provides the product for real use and detects errors which may not have been anticipated by the system developers.

4.2.5 Unit Testing:

Each module is considered independently. it focuses on each unit of software as implemented in the source code. it is white box testing.

4.2.6 Integration Testing:

Integration testing aims at constructing the program structure while at the same constructing tests to uncover errors associated with interfacing the modules. modules are integrated by using the top down approach.

4.2.7 Validation Testing:

Validation testing was performed to ensure that all the functional and performance requirements are met.

4.2.8 System Testing:

It is executing programs to check logical changes made in it with intention of finding errors. a system is tested for online response, volume of transaction, recovery from failure etc. System testing is done to ensure that the system satisfies all the user requirements.

4.3 Implementation and Software Specification Testings

Detailed Design of Implementation

This phase of the systems development life cycle refines hardware and software specifications, establishes programming plans, trains users and implements extensive testing procedures, to evaluate design and operating specifications and/or provide the basis for further modification.

Technical Design

This activity builds upon specifications produced during new system design, adding detailed technical specifications and documentation.

Test Specifications and Planning

This activity prepares detailed test specifications for individual modules and programs, job streams, subsystems, and for the system as a whole.

Programming and Testing

This activity encompasses actual development, writing, and testing of program units or modules.

User Training

This activity encompasses writing user procedure manuals, preparation of user training materials, conducting training programs, and testing procedures.

Acceptance Test

A final procedural review to demonstrate a system and secure user approval before a system becomes operational.

Installation Phase

In this phase the new Computerized system is installed, the conversion to new procedures is fully implemented, and the potential of the new system is explored.

System Installation

The process of starting the actual use of a system and training user personnel in its operation.

Review Phase

This phase evaluates the successes and failures during a systems development project, and to measure the results of a new Computerized Transystem in terms of benefits and savings projected at the start of the project.

Development Recap

A review of a project immediately after completion to find successes and potential problems in future work.

Post-Implementation Review

A review, conducted after a new system has been in operation for some time, to evaluate actual system performance against original expectations and projections for cost-benefit improvements. Also identifies maintenance projects to enhance or improve the system.

THE STEPS IN THE SOFTWARE TESTING

The steps involved during Unit testing are as follows:

a. Preparation of the test cases.

b. Preparation of the possible test data with all the validation checks.

c. Complete code review of the module.

d. Actual testing done manually.

e. Modifications done for the errors found during testing.

f. Prepared the test result scripts.

The unit testing done included the testing of the following items:

1. Functionality of the entire module/forms.
2. Validations for user input.
3. Checking of the Coding standards to be maintained during coding.
4. Testing the module with all the possible test data.
5. Testing of the functionality involving all type of calculations etc.
6. Commenting standard in the source files.

After completing the Unit testing of all the modules, the whole system is integrated with all its dependencies in that module. While System Integration, We integrated the modules one by one and tested the system at each step. This helped in reduction of errors at the time of the system testing.

The steps involved during System testing are as follows:

- Integration of all the modules/forms in the system.
- Preparation of the test cases.
- Preparation of the possible test data with all the validation checks.
- Actual testing done manually.
- Recording of all the reproduced errors.
- Modifications done for the errors found during testing.
- Prepared the test result scripts after rectification of the errors.

The System Testing done included the testing of the following items:

1. Functionality of the entire system as a whole.
2. User Interface of the system.
3. Testing the dependent modules together with all the possible test data scripts.
4. Verification and Validation testing.
5. Testing the reports with all its functionality.

After the completion of system testing, the next following phase was the Acceptance Testing. Clients at their end did this and accepted the system with appreciation. Thus, we reached the final phase of the project delivery.

Chapter 5

LANGUAGES AND SOFTWARES TO IMPLEMEMT

5.1 Python

Python is a high-level programming, extensively used for Machine Learning, face recognition, Artificial Intelligence, Data Science, etc. new emerging technologies. As python is easy to use with syntax and semantics, it chosen for these technologies. We used python language to implement the application using Django framework.

Python Django provides a web and mobile application interface to send and receive requests from server. It has its own admin panel which is in built if we installDjango. The admin panel stores all data in the database and give the facility to create, update, delete and modify the data. Due to the simplicity of Python, itis chosen for making mobile applications.

For making any application in python, there is need of virtual environment to separate our modules and files from other python files and directories. Python has its own package management and library of modules with rich sources of information including NumPy, re, pandas, matplotlib, OpenCV, json, random, socket, tkinter, turtle, urllib, xml, etc.

5.2 Java

Java is a widely used language as it performs all the task needed to make any software application, mobile application, server connection, android application, distributed systems. As Java is a general-purpose language, it widely used in every field of Information Technology.

Java uses JVM (Java Virtual Machine)to develop, compile and run the code correctly. Java known for its features like robustness, exception handling, simplicity, Object Oriented, Secure, High Performance, flexibility, Multithreaded, Platform Independent, etc.

These features make JAVA, one of the most popular language. Java behave as a backbone to other frameworks to work properly. We are using JAVA with Android Studio to develop our Android Application. JAVA works great to develop a good and interactive application.

5.3 Android Studio

Android Studio is the desktop application used to develop android applications and for editing existing android projects. Android Studio is a replacement of Eclipse Android Development Tools (ADT) used as the primary IDE for developing native Android applications.

The latest version ofAndroid Studio is 3.5,which makes the development android application even easier and interactive. The software consists of Gradle, AVD, Java and XML files, etc. Gradle is used for building and preparing the application for debugging and editing purpose.

It is an open source software application for build automation system used for building android applications using the concept of Apache Ant and Apache Maven. Android Virtual Device (AVD)is used to run our android application without installing in android phones.

It provides a virtual android device to run the applications. Different AVDs are available according to different android versions. Java files are used to write the functionality of the application and XML files are used to improve the appearance of the application.

Chapter -6

Working and Methodology

6.1 Working

The proposed system, which we have designed, works on below methodology.

Here we are detecting the facial key points of lost person; dlib facial landmark prod6uces about 68 unique points for a face. It uses a one-shot learning technique. Those produced points are float values with accuracy of about 8 points after the decimal. It is something like this-

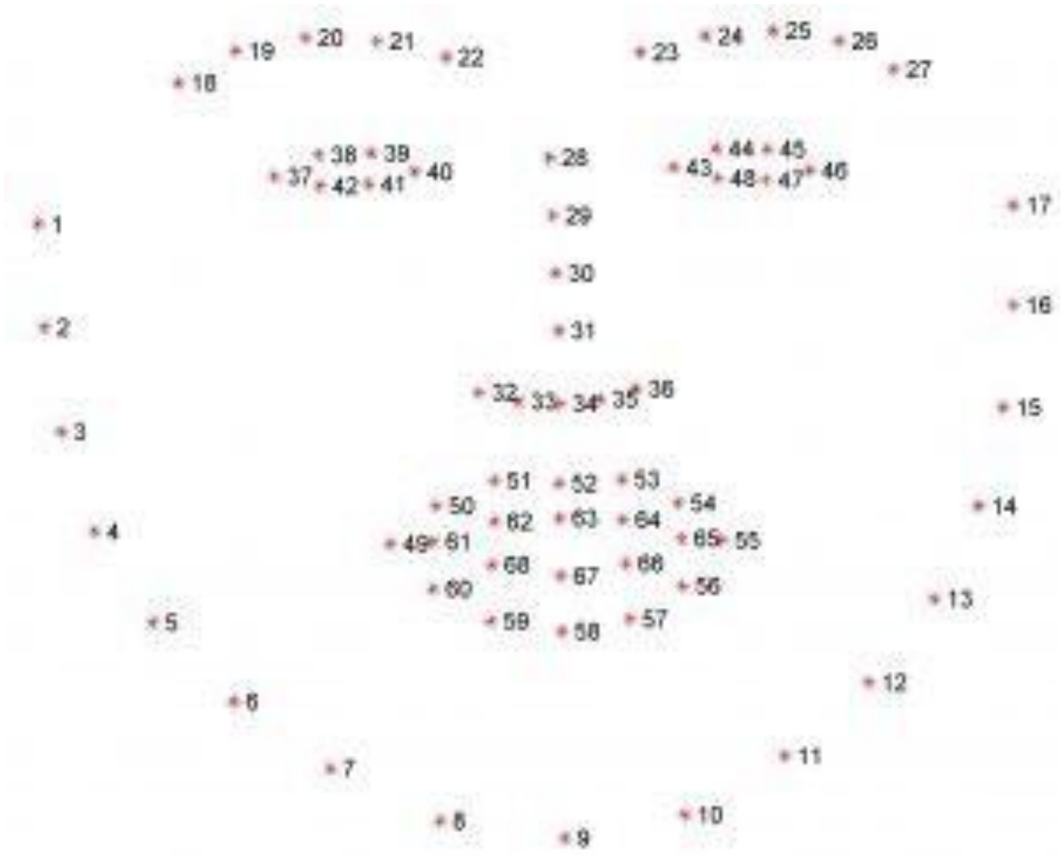


Fig.3. Facial Landmark

When the desktop application registers about three cases, dlib generates 136 * 3 facial landmark points. 136 is the count as x, y coordinate would be generated for each point, there are 68 points, and three is the number of cases. Then the classifier is trained based on these points. Suppose if KNN dispense the facial landmark points in the plot where RED corresponds to Person 1, GREEN for Person 2 and BLUE for Person 3.

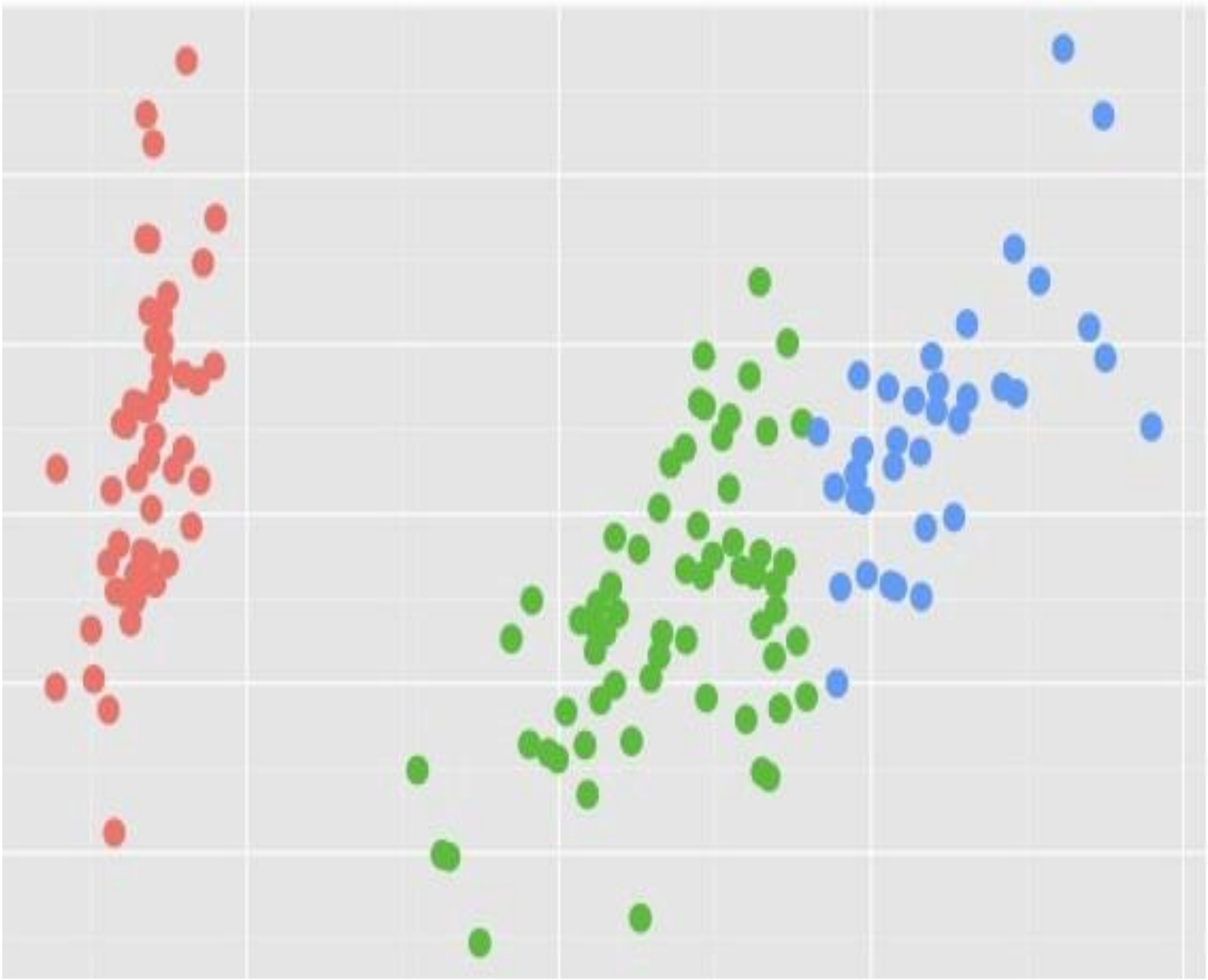


Fig. 4. Working of KNN Classifier

After this for matching any person's face, we need to simply produce facial landmarks of that person and we will then try to predict the confidence using the KNN classifier, which we trained, if the confidence goes above 60 then it is said that it is the same person.

Now, if a person is matched using the KNN model, we trained then as output, we will get the encoded label. This encoded label will contain information of that person.

The application name is "Missing Person". First of all, install the application. Then Android OS will check the compatibility of application with the current version while installing the application. Now, when we turn on the application, the first page appears on the screen is to a button "Get Started".

On clicking the button, a new activity opens. On this page, there are two options, either search a person by uploading the image and matching the face, or adding the details of new missing person. If we choose to add a missing person, details like name, age, address, contact number, image of the person, description, etc.were to be answered.

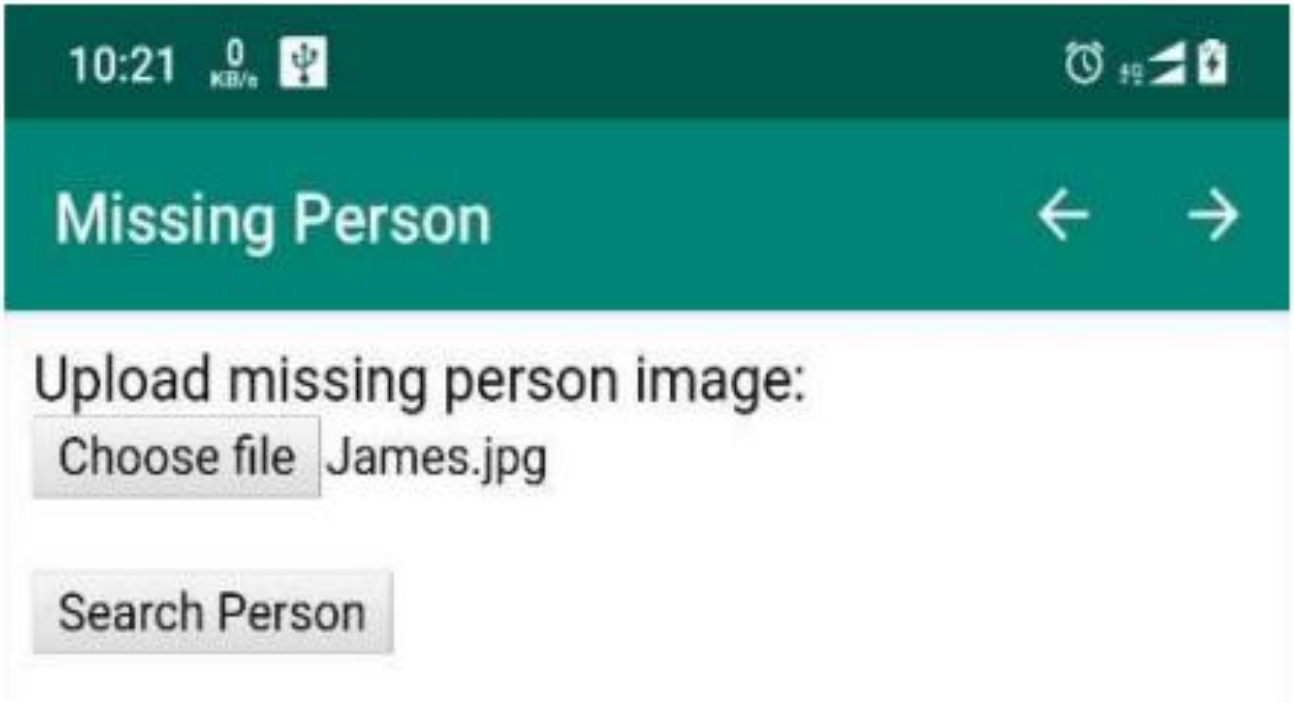
After filling the details, the details are added to the database and we have a new missing person saved in our admin panel. And if we want to search a missing person by an image, just upload the image of the person and click on search button.

On clicking on search button, our algorithm of face matching gets started. First it collects the number of saved images, then loop through each image and compares the uploaded image with the images saved in the database. If any of the image face matches, it breaks the loop and shows the message "The image is matched by name …….".

It tells that the match is found and we can get the details of the missing person by referencing that image name in the database stored in the admin panel. But if the image is not matched with the database images, then a message "this is not matched" appears on the screen.
As the details of the person are confidential, so we made it accessible to only those people who are authorized. People can search the images but the details can be seen in the presence of authorized person through the admin panel. It only notifies to people whether a match is found. As seen from below screenshots of the application.

On searching an image, the person image matched because it was saved in the database and face matching algorithm works properly. Figure shows the process of uploading an image of the person. When clicking on Search Person button, the process of facial recognition starts recognizing the images stored in the database.

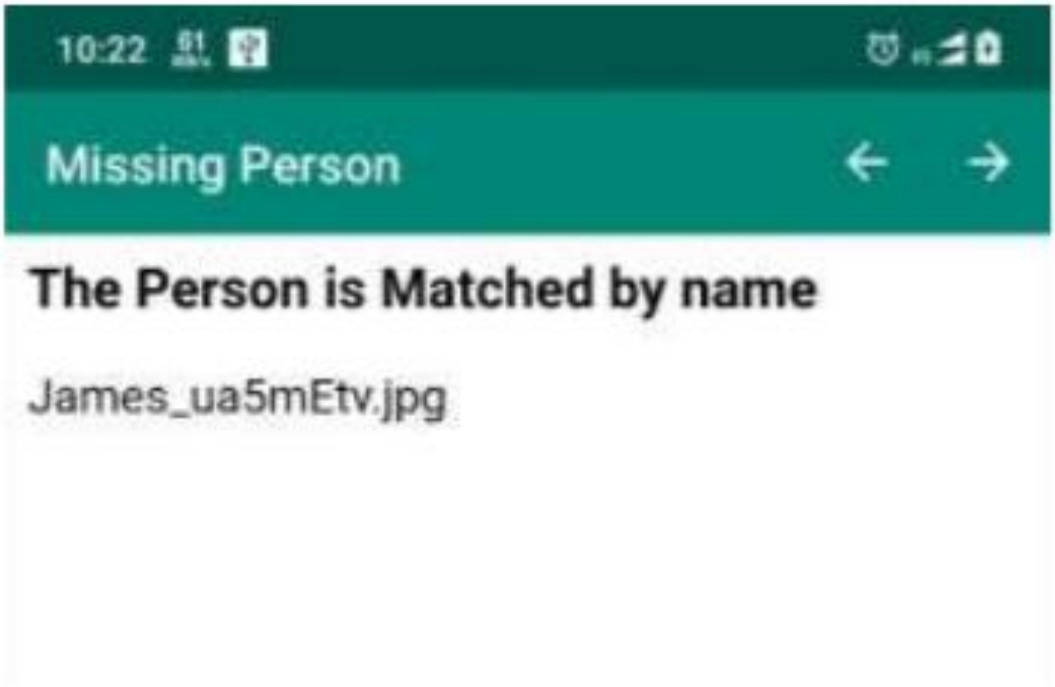
If there is a match, then the corresponding message is displayed as seen in figure. If there is no match, then match not found is displayed on the screen. Then we can check the details of the person through admin panel. Admin panel will be accessible by IP address http://52.12.145.106/admin/.



Upload missing person image:

James.jpg

Fig 5.1: Uploading image for searching



The Person is Matched by name

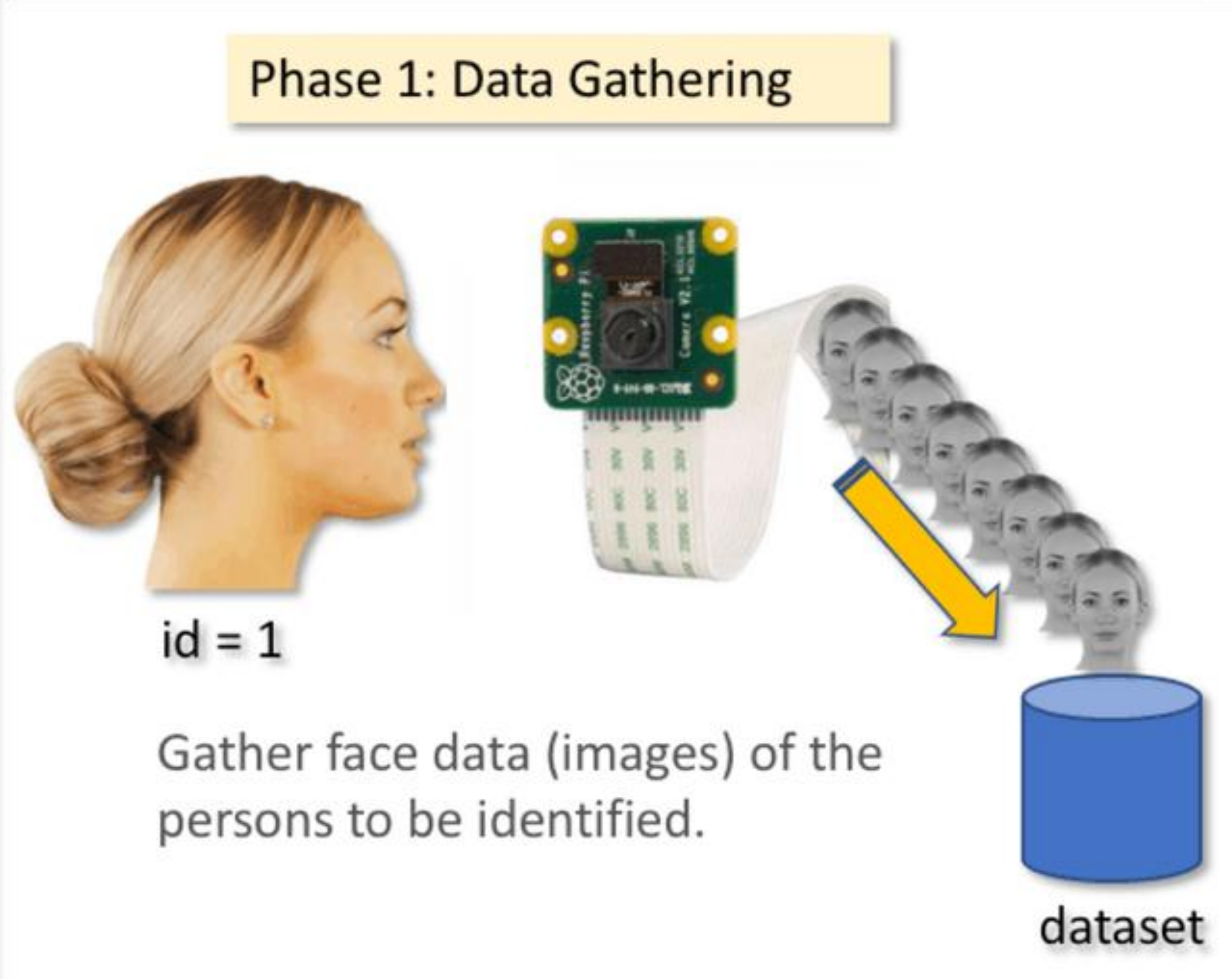
James_ua5mEtv.jpg

Fig 5.2: Result after searching

Data Gathering

I really recommend that you take a look at both tutorials.

Saying that, let’s start the first phase of our project. What we will do here, is starting from last step (Face Detecting), we will simply create a dataset, where we will store for each id, a group of photos in gray with the portion that was used for face detecting.



First, create a directory where you develop your project, for example, FacialRecognitionProject:

```
mkdir FacialRecognitionProject
```

In this directory, besides the 3 python scripts that we will create for our project, we must have saved on it the Facial Classifier. You can download it from my GitHub: haarcascade_frontalface_default.xml

Next, create a subdirectory where we will store our facial samples and name it “dataset”:

```
mkdir dataset
```

6.2 Methodology

The proposed system makes use of Face Recognition for missing peoples' identification. The architecture of our framework is presented in figure .

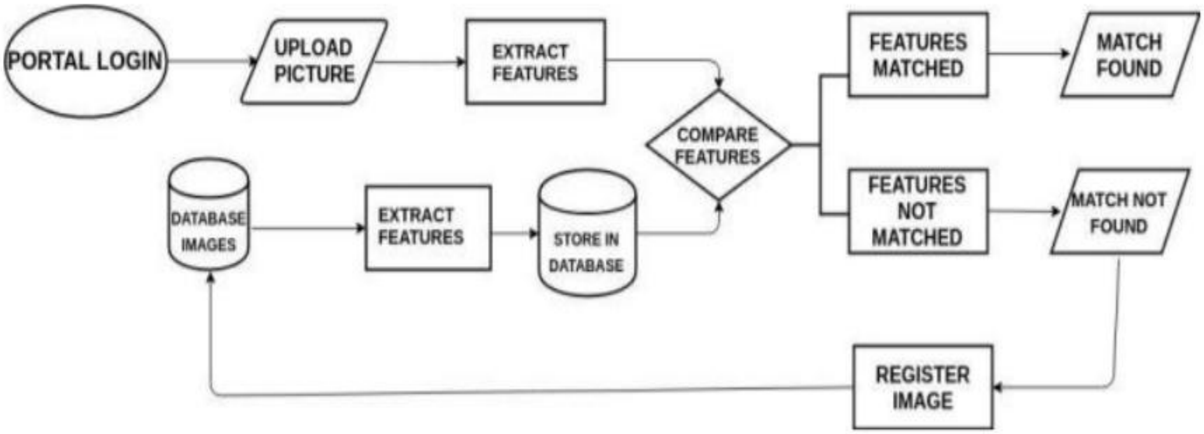


Fig 6: The Architecture of the proposed People Identification System

Here the public or police who finds a suspicious person (child, mentally challenged person, etc.) on the road uploads a picture of that person into the portal. Our algorithm extracts the face encodings of the image as shown in Figure and compare with that of the face encodings of the previously existing images in the database.

If a match is found, an alert message will be sent to both the concerned police officer and the parent/guardian of that person in the image. If a match is not found, then the person will be provided with the option of registering that face as a new entry to our database with the location they found and remarks.

Whenever public or police upload an image, the face encodings of the image are extracted and then compared to the face encodings of the images stored in the database. If the distance between the encoding of the uploaded image and the encoding of the image in the database is less than or equal to the threshold, then the face in both the images is of the same person as shown in Figure 3 and Figure 4.

If that is the case, the user is notified that a match is found along with the picture from the database that matched with the uploaded picture. If the distance between the encodings is more than the threshold, it means that the faces in the images are not of the same person's. By this way, our proposed system will help in identifying the missing people.

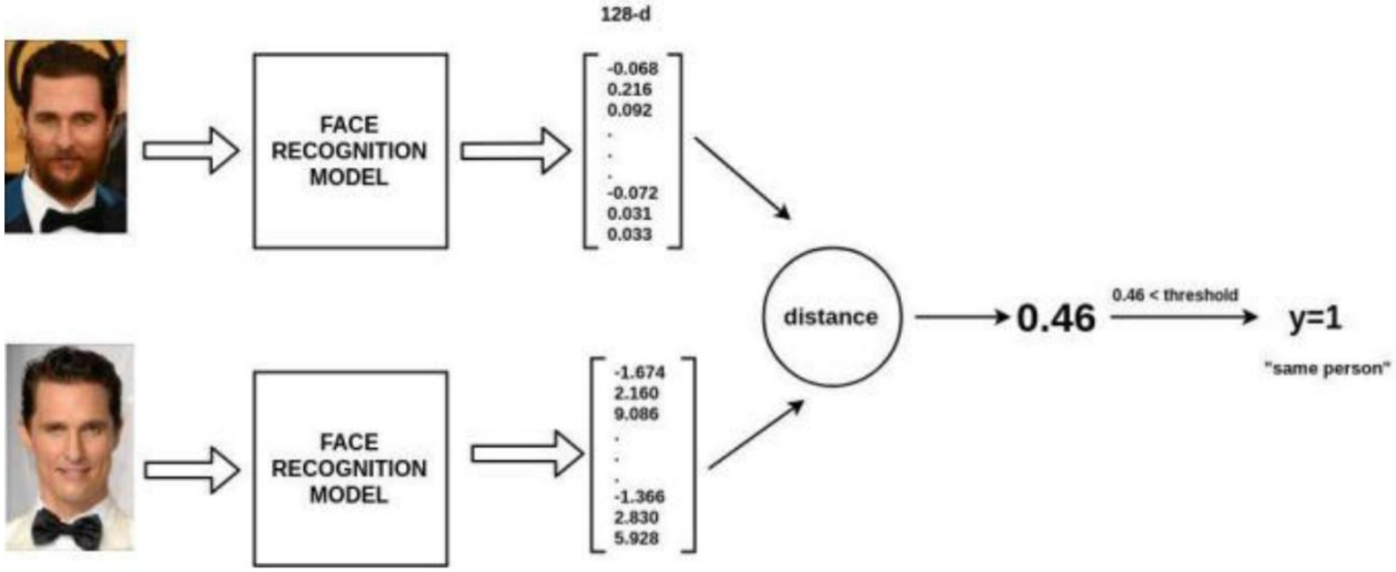


Fig 7. Comparing Face encodings of two images

The model we have used involves three main steps to perform face recognition.

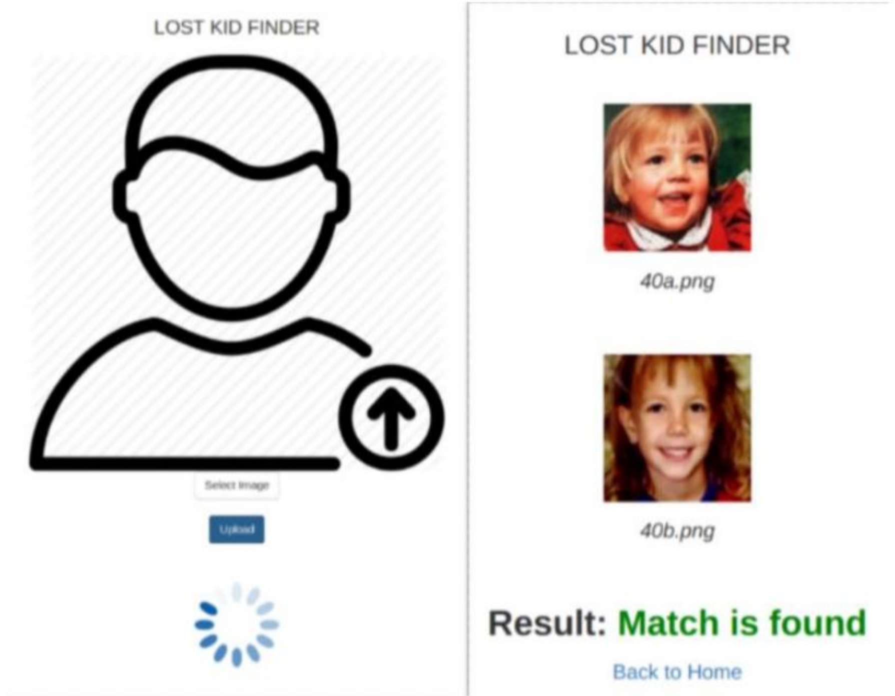
STEP 1: Face detection – Firstly, face patterns are generated using Histogram of Oriented Gradients (HOG) algorithm. The images are made black and white. Here, the part of the images that looks more like the original HOG face pattern is found. Finally, the detected face is bounded by a bounding box.

STEP 2: Sixty eight specific points (landmarks) that are existing on every face are figured out by using the face landmark estimation algorithm. From the landmarks found, image transformations like scaling, shearing and rotation are used by the OpenCV's affine transformation to make the lips and eyes appear in the same location on every image.

STEP 3: The face images are then passed through deep convolutional neural network. By doing this, we obtain 128 measurements which are 128 dimension hypersphere. And no one knows which parts of the face the 128 measurements representing. All we know is that the network outputs the same 128 numbers for two different images of the same person.

STEP 4: Finally, a linear SVM classifier is used to recognize the face. The classifier has been trained in such a way that it can take the measurements from a test image and gives the closest match as output.

A Flask api interface accompanies our model to give the user a better user experience as shown in Figure 4. When the user opens our application they will be asked to upload a image of the missing person. If a match is found, they will provided with the image and details about the match. If match is not found, they will be asked if they want to register that image as a new entry into our database. If they wish to register, they will be asked to enter the details about the image as shown in below figure.


LOST KID FINDER

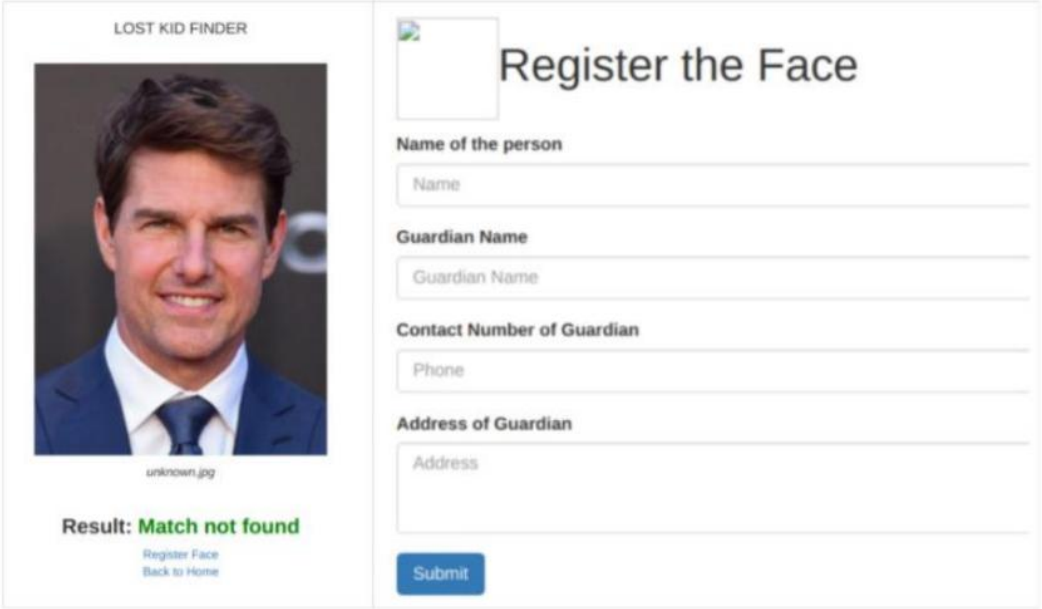
LOST KID FINDER

40a.png

40b.png

Result: Match is found

Fig 8. Interface for the system built using the Flask framework


LOST KID FINDER

unknown.jpg

Result: Match not found

Register the Face

Name of the person

Name

Guardian Name

Guardian Name

Contact Number of Guardian

Phone

Address of Guardian

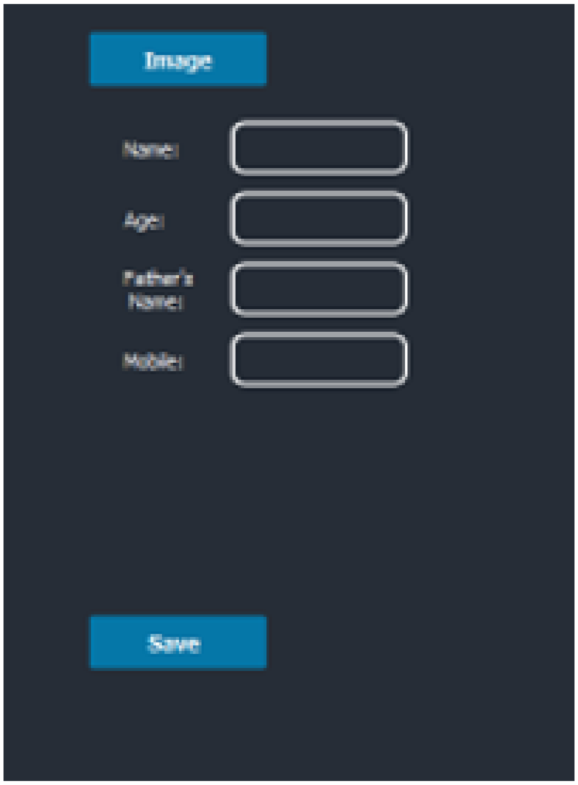
Address

Fig 9. Face Registration form

6.3 Project Implementation

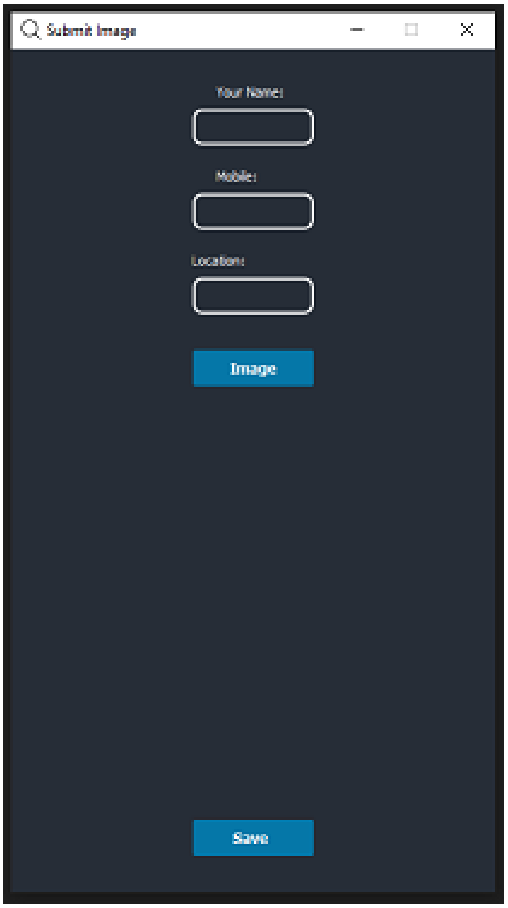
1. Registering New Cases

The first step is to register a new case. The GUI application is built using PyQT5 that allows you to collect all relevant information and store it in database Postgres.



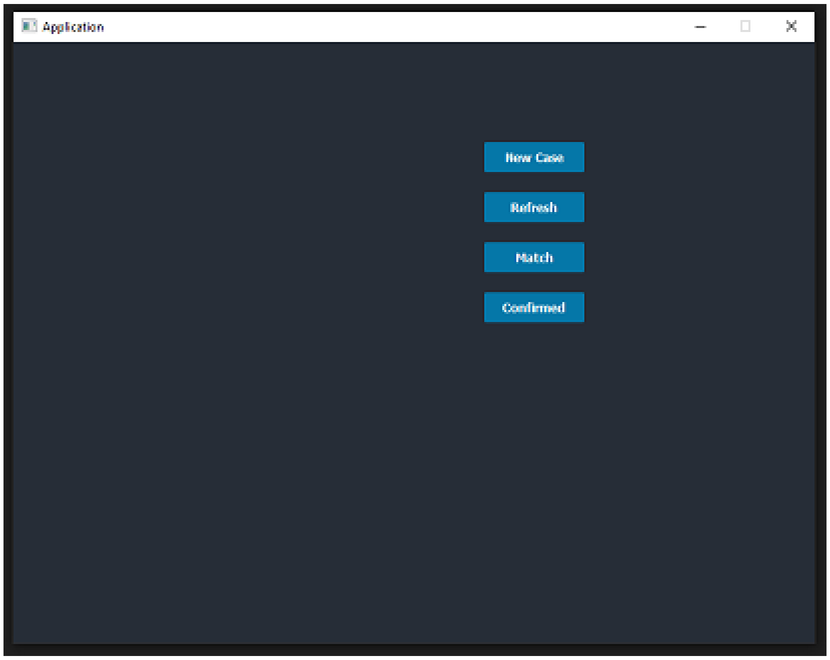
2. Waiting for Users to submit images

So far we have only talked about 'how new cases will be registered', the next thing we have to do is to match these registered cases but who do we match it with? This is where ours Users come in. These users are common people like you and me who wants to make a change in the society. The common people will use an application on their mobile to submit photos of people who they think have lost or found begging while keeping them their identity anonymous. The anonymous part is very important because they fear of local *Gundas* that might create trouble for them.



3. Matching Cases

The next step is to match the case images and user submitted images. To match **KNN Algorithm** is used.



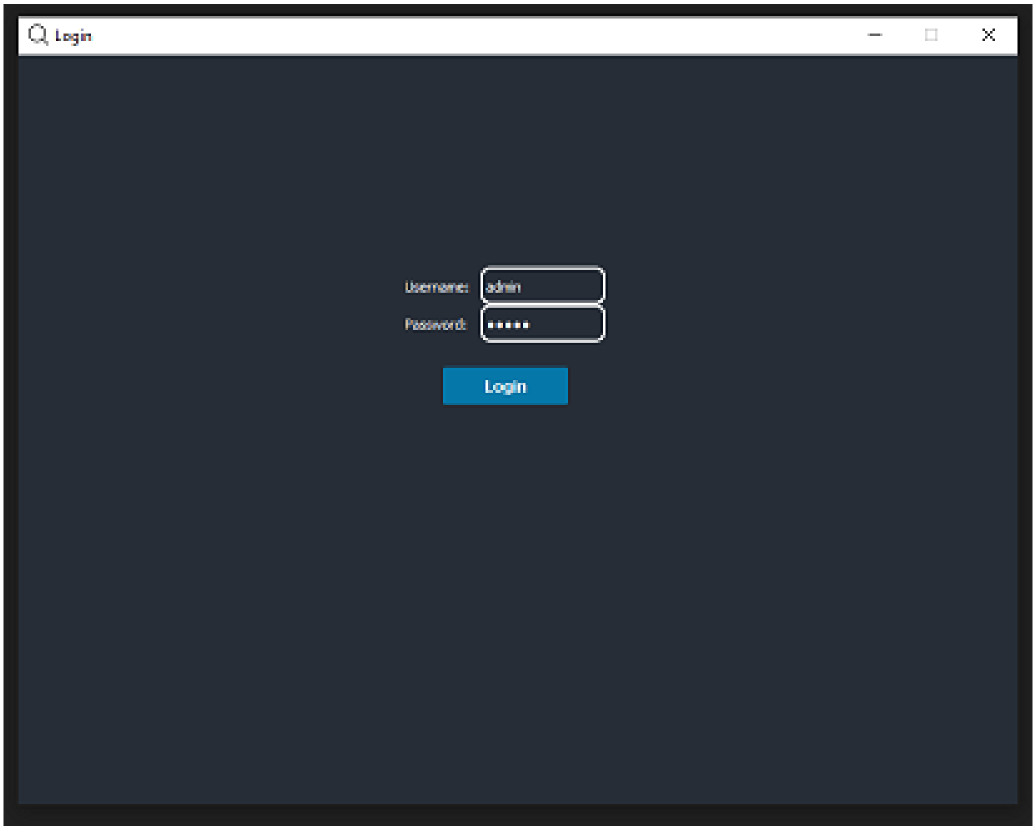
How to Run

1. With Docker (Easy)

Prerequisites

Docker (docker-compose as well)

```
$ git clone https://github.com/gaganmanku96/Finding-missing-person-using-AI
$ cd Finding-missing-person-using-AI
$ docker-compose up --build
$ cd app
$ pip install -r requirements.txt --no-cache-dir
$ python login_window.py
```



Username: admin

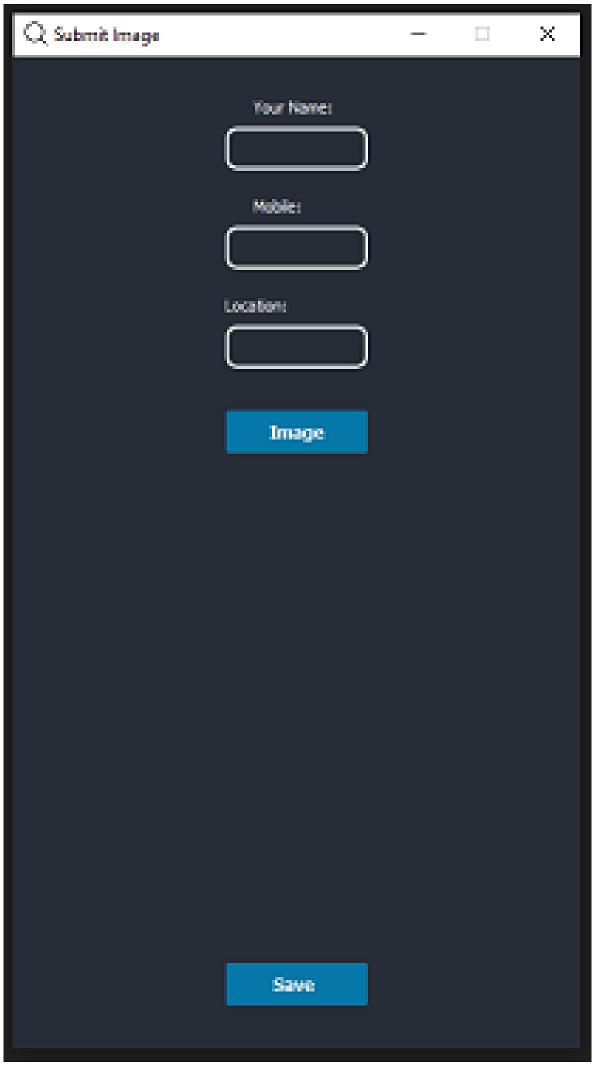
Password: •••••

After logging in you'll see the main screen through which you'll be able to submit cases.

To run the mobile application:

```
$ cd mobile_app
or (if you are inside app dir)
$ ../mobile_app
$ python ui.py
```

After that you'll see a window like this



You can this to submit user images or you can create your own mobile app.
Once done you'll have to **Click on Refresh** button on train KNN Model and then on **Match** to start Matching Images.

2. Without Docker (Intermediate)

Here are the step you have to do

1. Install Postgres Database and replace the username and password in config/.env.file
2. The next step is to run database and make sure it is working.

```
$ cd database
$ pip install -r requirements.txt
$ uvicorn main:app --port 8002
```

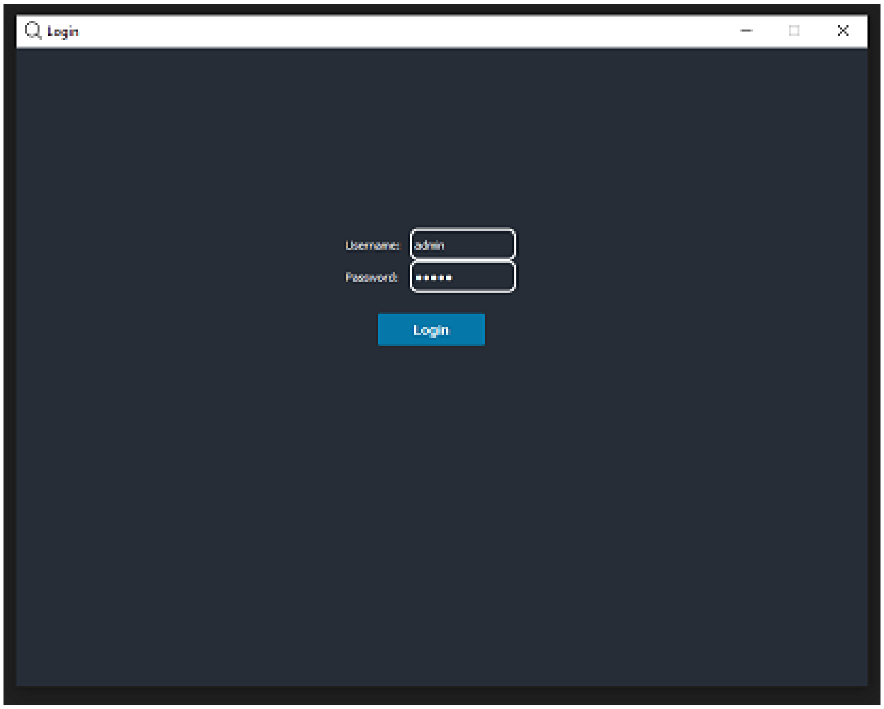
3. Next, the face encoding api

```
$ cd face_encoding
$ pip install -r requirements.txt
$ uvicorn main:app --port 8000
```

If you are using non-conda environment like venv then it might give error while installing dlib library.

4. Running the application

```
$ cd app
$ pip install -r requirements.txt
$ python login.py
```

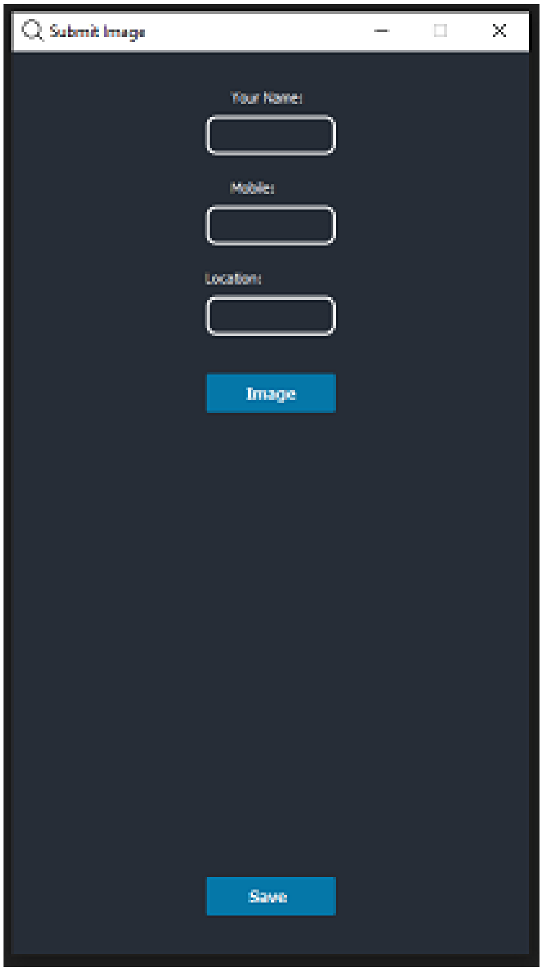


Username: admin
Password: •••••

After logging in you'll see the main screen through which you'll be able to submit cases.

To run the mobile application:
$ cd mobile_app
or (if you are inside app dir)

$ ../mobile_app
$ python ui.py
After that you'll see a window like this



You can this to submit user images or you can create your own mobile app.

Once done you'll have to **Click on Refresh** button on train KNN Model and then on **Match** to start Matching Images.

Chapter -7
Results and Discussion

We found that all papers which we studied are having some different issues regarding the pixel size and motion of image but we are going to develop a system which will give better result. So our aim is to make a dynamic system which will be having the prediction outcome probability higher even if change in image.
We found that using KNN algorithm is easy to match picture with high accuracy.

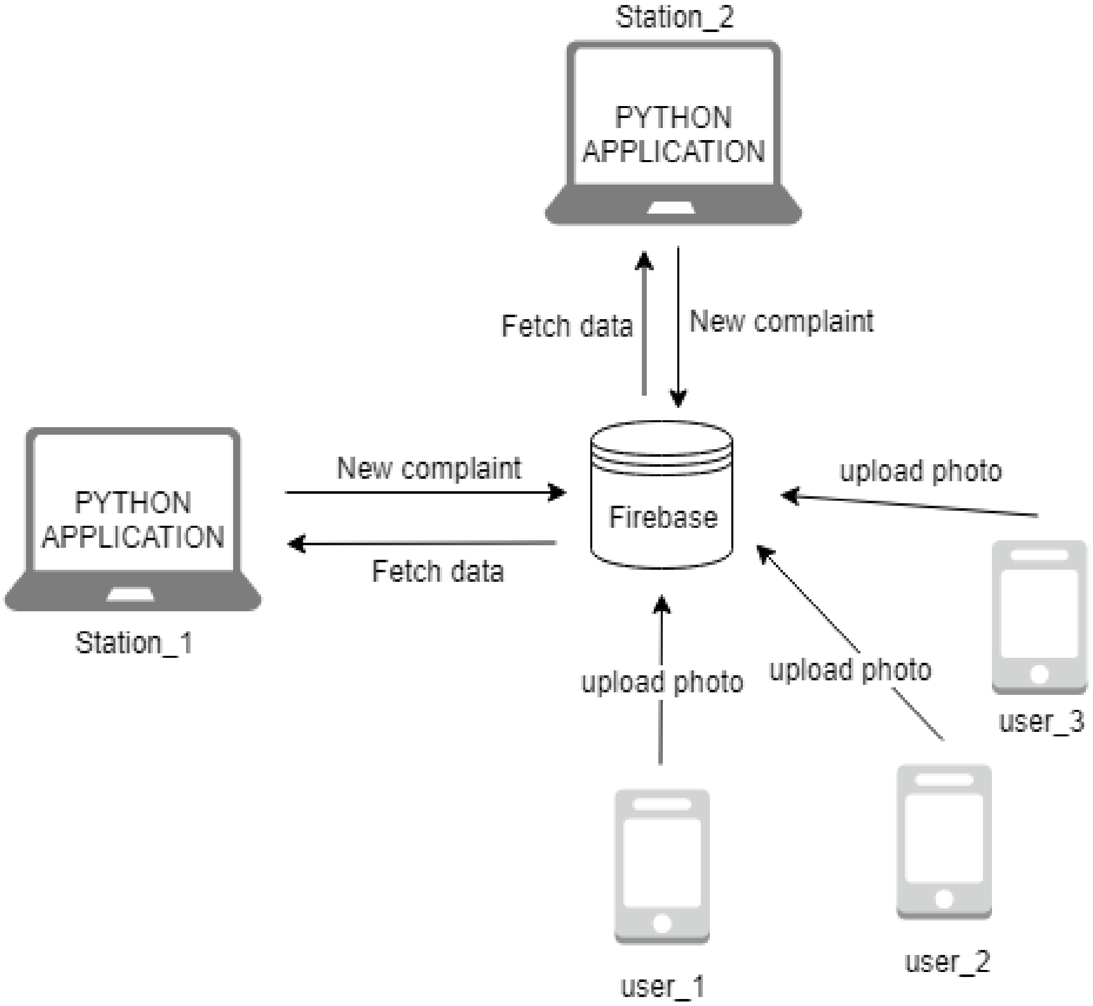


Figure 10: System Architecture of Project

The Face Recognition model we used has an accuracy of 99.38% on the Labelled Faces in the Wild Benchmark which comprises of 13,000 images .

The testing conducted by us yielded an accuracy of 97.5% where the dataset included 82 images – 41 pairs which included images of kids, teens, adults (male and female) with age gap, different hairstyles, filters etc. as shown in Figure 6. The dataset we used is taken from Imaging and Vision site.

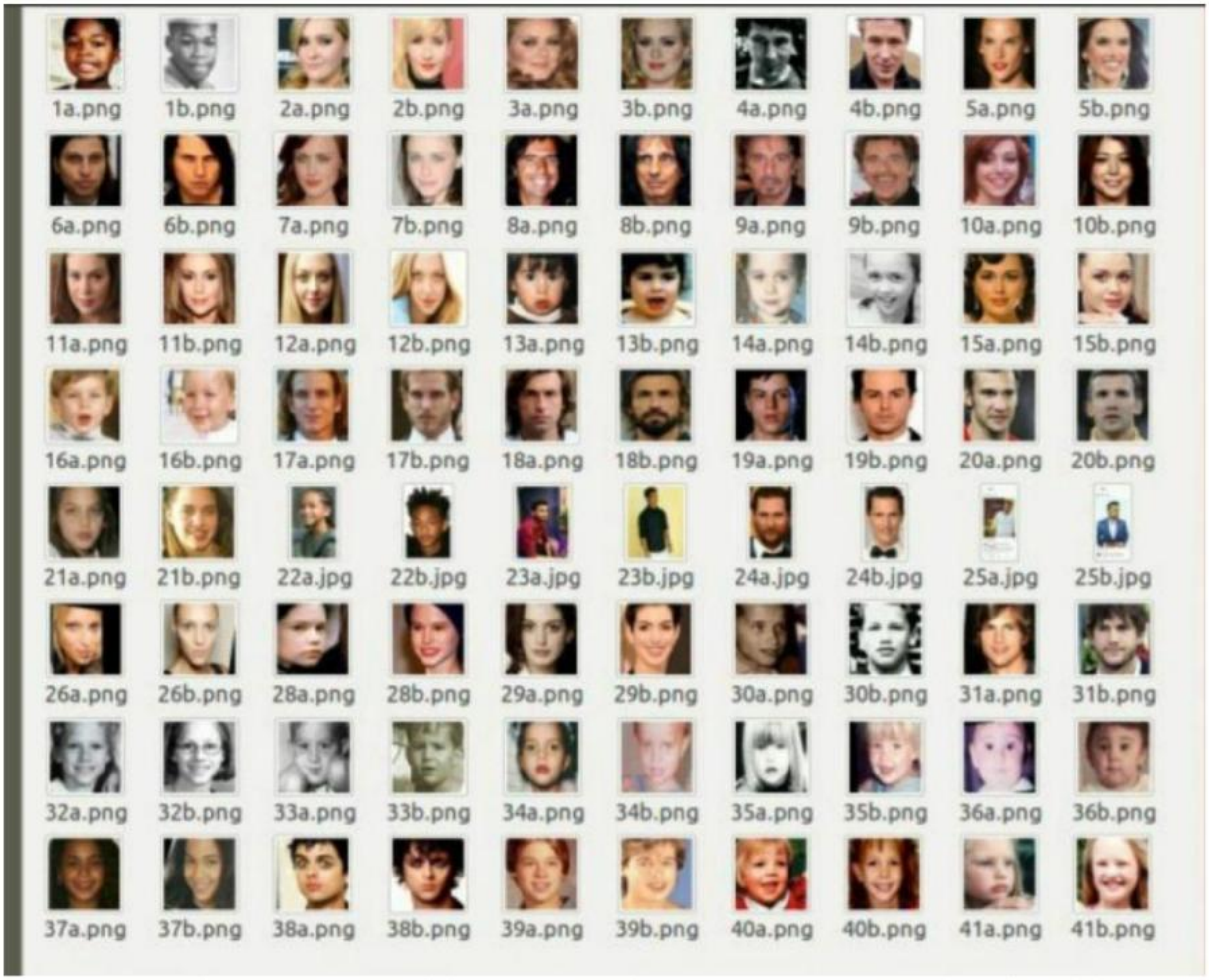


Fig 11. Set of images used as a test set to test the algorithm.

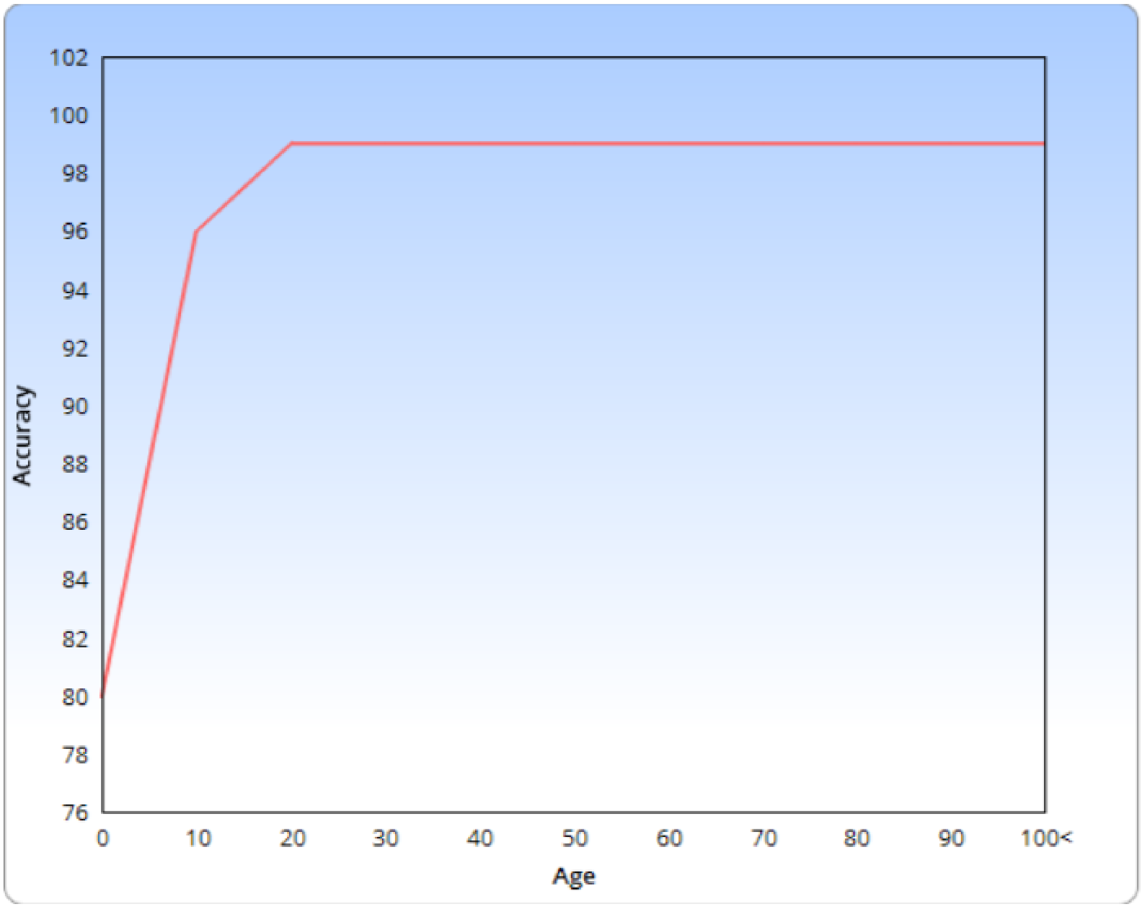


Fig 12. Graph showing the relationship between age and accuracy

Chapter 8
Conclusion and Future Scope

8.1 Conclusion

In previous applications, if some of them availing the feature of saving details then the feature of facial recognition found missing and vice versa. Efforts are made on implementing face recognition possible with much better accuracy and so this method is very helpful in recognizing missing person.

The application uploads, retrieves, deletes and updates the data of the missing person. A searching option is given to match the faces and identify the details ofthe missing person.This application is for common people for uploading and searching the details, for police, it gives the features to check the details of the missing person and admin panel for modifying and storing the details in the database. The server of the application is also handled by the Admin itself.

Moreover, the procedure of identifying the missing people is done quickly in this way. Our system put back the manual method of scrutinize the database of single picture to examine, by a well-planned face recognition method which does the work in no time.

By this way, the process of identifying the missing people is fastened. Our system replaces the manual method of scanning through the databases for each picture to check the match, by an efficient face recognition method which finishes the work in no time.

Though our system has a small limitation i.e. when the age of the person is between the age 0 and 10 the accuracy drops as shown in Figure 7. This is due to the incomplete growth of facial features at that age. We look forward to overcome this limitation in the future.

8.2 Future Scope

The upcoming work on which we are targeting is to calculate theworking tendency ofthe application, so if any problem occurs, we can resolve it as soon as possible and show that our proposed system is better than pervious applications. Also, we were planning to append following features to the application. Automatic alertfor recognizing missing person.Automatic notification system is also under working for improving the working of the application.

In the future, we are planning to extend this system further by connecting our system to public cameras and detect faces real-time. The frames will be continuously sent by the public cameras to our system where our system will be continually monitoring the frames. When a lost person is identified in any of the frames, it will be notified to the concerned authorities.

The more complex and intelligent that facial recognition becomes, the harder it is to understand how it actually works. A neural network’s reasoning is integrated into the behavior of thousands of “neurons,” which are combined into hundreds of interconnected layers.

In the coming years, the US will need to make difficult choices about AI: individuals such as Stephen Hawking and Elon Musk have voiced their hesitancy on using AI, suggesting that it could end up destroying humanity.

Yet, some countries are barging ahead in the AI facial recognition realm; currently, China is leading the industry. China's goal is to establish industrial standards now, so that they can have a hand in shaping the development and implementation of worldwide standards. As the technological battleground between the US and China intensifies, we are sure to see more and more AI solutions and standards developed at a rapid rate.

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