Finding Missing Person Using Face Recognition System - Khoj

VIJAY DEEP[1], GOVIND KAUSHIK[2]
[1, 2] *Dronacharya College of Engineering, Gurgaon, Haryana*

Abstract— A large number of people go missing every single day because of countless reasons such as age, mental conditions or emotional disorder, Alzheimer's disease, etc. Most of them remain untracked and the process to trace the missing person gets fainted. This research paper focuses on well-being of police and public by speeding up the searching process of the lost person. Whenever a new case is filed, their record is stored in the application's database. When anybody encounters such person, he will capture his picture and search the record in the existing database. If a match is not found, then they can upload the details onto the database (optional: if known) and the current location while uploading will be saved and the case will be informed to the higher authorities. The other case is if the match for the lost person is found, the details from the database will be retrieved and police or the family members will be informed. The accuracy obtained on the face recognition model is 96 %.

Face Detection, Face Recognition, Finding lost Person, OpenCV, SQL

I. INTRODUCTION

1.1 Motivation

A missing person can be anyone who is lost voluntarily or involuntarily irrespective of age. "A deeply disturbing fact about India's missing children is that while on an average 174 children get missing every day, half of them remain untraceable." [1] According to the lost persons in crime rates in India Data, 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 cases keep increasing. [2] "Many people lose their abilities to recognize familiar locations and faces due to Dementia or Alzheimer's disease, due to which they go missing. In India, more than 4 million people are estimated to be suffering from Alzheimer's and other forms of dementia, giving the country the third highest caseload in the world, after China and the US. India's dementia and Alzheimer's burden are forecast to reach almost 7.5 million by the end of 2030 (News18, 2018 study)." [3]

Whenever a missing complaint is filed at the Police station, it goes through lengthy interrogation, and the process to trace the missing person gets fainted Family members belonging to the missing person go through suffering and stress during the process of tracking the missing ones.

1.2 Aim

The manual system of finding a person is not much efficient and takes a lot of time and man-force, sometimes lasting for years. To reduce the time to trace the whereabouts of the missing person, there is a need to come up with a better solution, using technology as an advantage. The proposed system presents a solution for the current problem using facial recognition that is a branch of computer vision. Facial Recognition comprises face detection, alignment, feature extraction, and a recognition task. Starting with face detection, it is the process of finding human faces in any digital image. Face alignment helps to recognise facial landmarks like shape of forehead, nose, slant of eyes and eyebrows etc. Followed by feature extraction, a prerequisite step for face recognition to distinguish between different faces.

II. LITERATURE SURVEY

Several studies on finding missing person using deep learning have been done previously.

An android application to track crime and missing cases was developed for all android devices which support at least Android 2.1 Platform. Objective was to reduce missing cases taking place by introducing technology to make the system more accessible. Front

end was done using Android studio, at backend SQL was used. At first the user had to provide phone number and then validate OTP. Features such as adding, removing, displaying, and searching complaints were provided, but it lacked the functionality of matching faces through face recognition. [4]

In one of an android application, users were able to search for their missing ones on the system, providing search criteria to make their search-relevant e.g. name of the missing person, age, and gender. If record was found, email alerts were sent to those who have reported missing cases and have subscribed to the service. [5]

The research "An Investigation on the Use of LBPH Algorithm for Face Recognition to Find Missing People in Zimbabwe", provides insights to make use of media to find the missing people, the system has a feature to capture an image of a person at instant. This will help decrease the searching time. The classifier used is Haar Cascade classifier and the GUI was Tkinter. [6]

On Google play, an application was developed with similar features of viewing missing cases, but the user could not add missing person's complaint, he can only view. [7]

The study "A Survey on Android Based Application on Missing Person Finder" used the SWF-SIFT (scale invariant feature transform) algorithm for comparison of two faces. This algorithm was robust to the scale of image and illumination, but overall accuracy of the system was 70-80%. The functionality of searching a person by filters was not provided to the user. [8]

In "Android App for Crime and Missing Person Reporter", the proposed system was transparent in the law-and-order process, FIR could be managed online by the user. Here the user has the option to look for the reports of missing person without login in the system. Both non-registered and registered users can use the application in emergency situations. Also, searching missing persons with the help of filters like age, location is not taken into consideration. [9]

A study on face recognition highlighted some of the difficulties in current systems regarding this task. The major challenges faced were illumination, face expression and pose variation i.e., when there is variation in light, expression, and location respectively. [10]

III. METHODOLOGY

3.1 Dataset Description

The database contains the images of missing people labelled as name_uniqueid. The details corresponding to the names are stored in a google spreadsheet as shown in fig 1 with their unique ids to maintain unicity of records.

Fig1: Image Dataset Format

Serial no.	Attribute Name	Data Type
1.	Related	String
2.	Name	String
3.	Age	Integer
4.	Gender	String
5.	PhoneNumber	Integer
6.	PinCode	Integer
7.	State	String
8.	Id	String
9.	Geostamp	Date/Time
10.	Geocode	Integer
11.	Geoaddress	String

Table1: Person details in spreadsheet

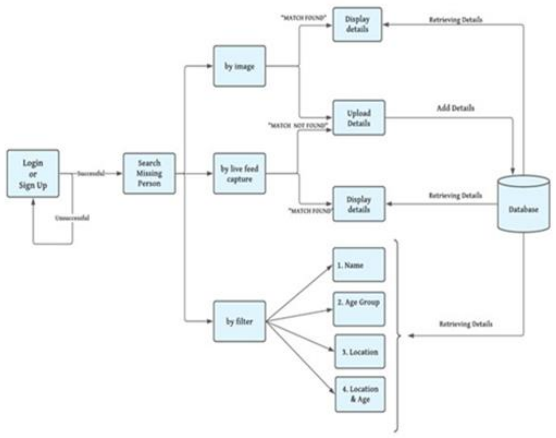

Fig 2: Proposed System's Framework

3.2 Model Architecture

The main functionality of the proposed system is to match the face of the person from a static image or a video frame, with our existing database using the face_recognition model. It takes various face features into consideration as described previously and stores them as encoding array. It requires two main libraries namely dlib and cmake. [11] The comparison between faces is controlled using a tolerance parameter whose default value is set to 0.6. Lower value signifies more strict comparison suggesting sensitivity. [12] Module returns a match if face is matched.

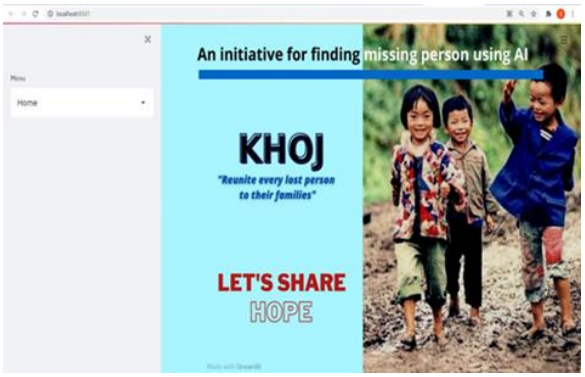

Fig3: Home page

The application begins with signup or login. Login credentials are stored in a database file and retrieved through SQL queries. After successful login, users can either search for a record or upload a new case as shown in Fig 4. Search provides the following functionalities to the user:

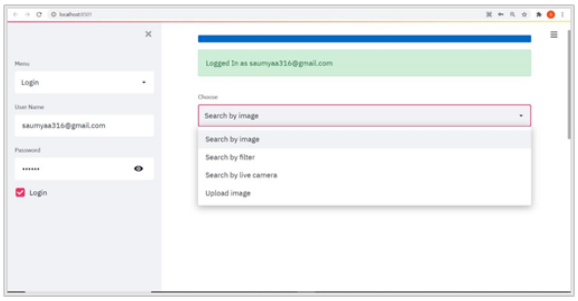

Fig4: Interface Functionalities

1. Search by Image: In this case, the user is asked to upload an image of the missing person which will be searched in the database. There are two use-cases for this. First, if the record is matched in the database, the details such as name, age, contact number, location, etc. associated with the missing person will be displayed to the user as shown in Fig 5. If the record is not found, the user is asked to upload a new record as shown in Fig 11.

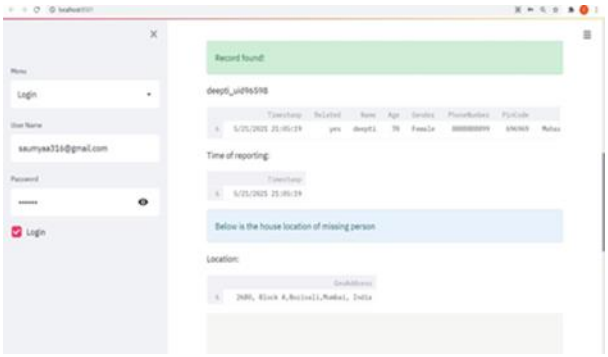

Fig 5: Search by name

2. Search by live-camera: This functionality asks the user for camera access as illustrated in Fig 6.

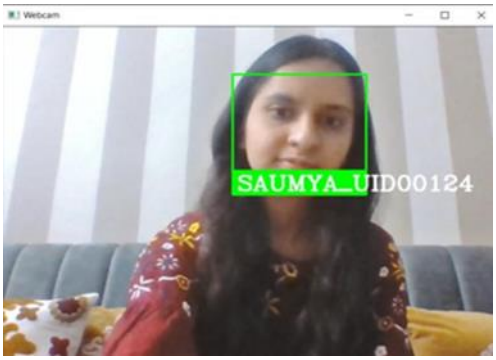

Fig 6: Working of live feed capture

After permitting, it takes around 25 seconds for the camera to turn on. It allows users to capture the face using cv2.capture and compare it with faces in database.[13] Further the details of the person matched are displayed to the user.

3. Search by filter: Apart from the above two options, users can easily search for records by applying following filters.

- Filter by name: The details corresponding will be extracted from the database when user inputs name as shown in Fig 7. There is an option of retrieving details through multiple filters in case there are several records found with similar names as displayed in Fig 8.

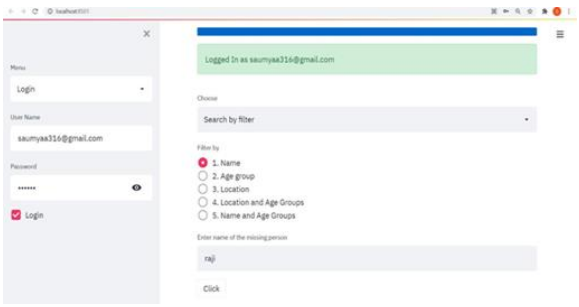

Fig 7: Filter records by name

- Filter by age group: A slider is provided to select a specific range of age if the stranger uploading case does not know the precise age. The details of people associated with the selected age group will be displayed.
- Filter by location: User will be asked to enter the state to get corresponding records.
- Also, the user has the option to select multiple filters at one time to retrieve records.

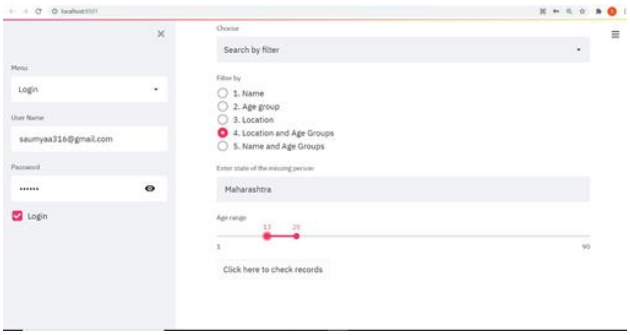

Fig 8: Search by multiple filters

If no match is found, then upload new record as shown in Fig 9.A link is provided to the user which will be redirected to the google forms as illustrated in Fig 10.

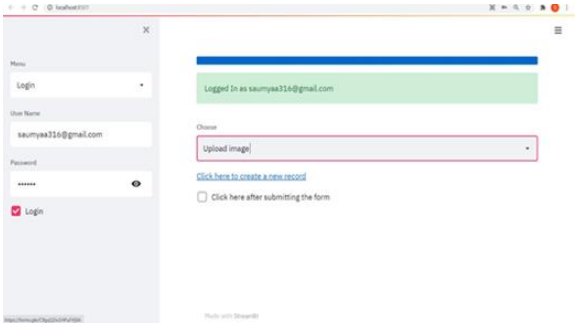

Fig 9. Upload Image if no existing record found

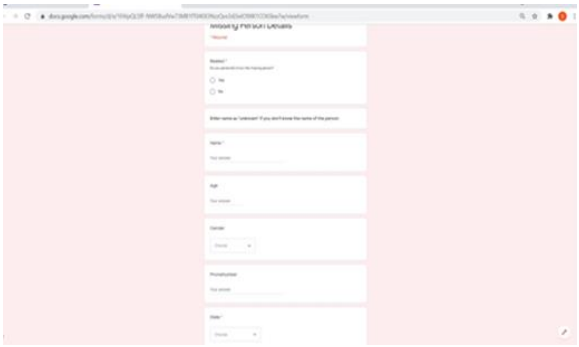

Fig 10. Google form to get details

The form will ask for details such as name, age, gender, contact number. On submitting, a new link is activated which will capture the current location of the user. To uniquely identify every missing person, a unique id is generated through the script editor of google form which is appended in the database. The user can upload an image of the missing person only after completing the above procedure. We have used a streamlit interface to deploy our project. Streamlit is a browser-based python framework open to all to create custom web apps for artificial intelligence. It helps to embed HTML code which can be helpful in changing the font size, font colour, etc. and provide an option to add URL, images etc seamlessly. [14]

3.3 Advantages of Proposed System over Existing System

The user can only access the applications after login with correct credentials.

Modules compared	Drawbacks
Haarcascade Accuracy achieved: 80%	1)The word Haarcascade is made up of 2 words Har and cascade where haar signifies a weak classifier. As it uses a weak classifier, it does not give good results. 2)Haarcascade works better for face detection purpose. 3)To train the model, a lot of positive and negative images must be provided to get some good accuracy score.
LDA Accuracy achieved: 93%	1)One major drawback in Linear Discrimination Analysis method is due to the possibility of increase in error rate if there is difference in illumination and pose. 2)Also, if the sample size is low, the classification accuracy decreases.
SVM Accuracy achieved: 91%	1)Support Vector Machine does not work well with large datasets or with datasets containing more noise where target classes overlap. 2)It will fail in cases where number of attributes for each data point exceeds the number of training data samples.

Table2: Comparison of models

In this proposed system, the model used for comparing faces is face_recognition which performs better when it comes to detecting and recognizing faces. It is computationally less expensive and more efficient.

The user has the option to search by filters like name, age, location. Also, they can make use of multiple filters at the same time to accurately retrieve the details of a missing person without uploading image. To upload a new record, user must fill the details through google form which makes the process easier and effective.

IV. EXPERIMENTAL RESULTS AND ANALYSIS

The traditional algorithms of face detection include AdaBoost, Haar-like, DPM, etc. These algorithms use face geometric features and template matching for face detection, which is difficult to consider both detection speed and accuracy. [15] Different face recognition models are compared in order to select the best one for our system. The model used for the proposed system is face_recognition which was the most convenient for this use-case. The rest of the models compared are as follows:

Face_recognition was chosen rather than above methods because this model gives much accurate results for both detection and recognition of faces. Face recognition works by saving the coordinate points of faces in two-dimensional arrays and then matches these points with the face points of the searched person. After considering these measurements, it calculates the distance using Euclidean distance and classifies the test image with minimum distance. It is much faster in training the model. Also, there is no need to provide multiple images for model training which serves as an asset for our system.

V. FUTURE RESEARCH SCOPE

Future work concerns ideas that can be incorporated with time, to improve our application. An Aadhaar card verification system can be integrated to verify the details of the user at time of login. This becomes necessary to avoid users uploading any malicious record. However, searching can be used by anyone in case of emergency.

To increase scalability and accessibility of our project, we can store data on cloud platforms. Further, this system can be deployed on an open-source application platform so that it can be used by people and help them find their lost ones. It will impact how fast our product will respond to changes and the quality of each change.

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